

ACTINO-  
THERAPY

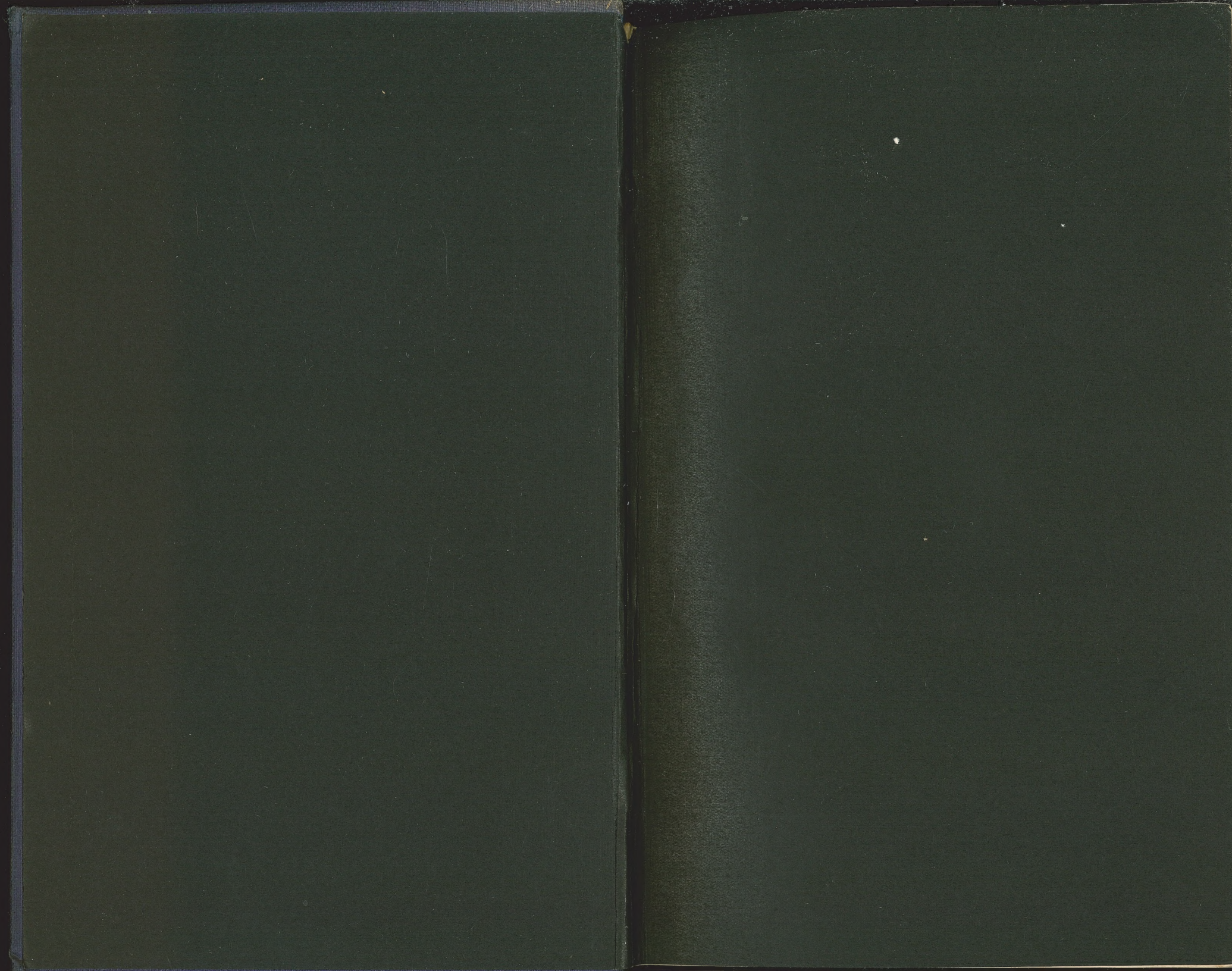
FALKNER

# ACTINOTHERAPY

H. G. FALKNER

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FIRST EDITION



ACTINOTHERAPY



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FOR GENERAL PRACTITIONERS

BY

H. G. FALKNER

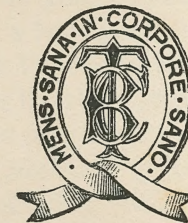
L.R.C.S.I., L.R.C.P.I., L.M. Rot. Dub., O.B.E.

ACTINO-THERAPEUTIST TO THE LONDON TEACHERS' ASSOCIATION

LATE COL. A.M.S., T. (RET.); LATE O.C. MAUDSLEY NEURO-

LOGICAL HOSPITAL, DENMARK HILL; ALSO LATE

MEDICAL OFFICER OF HEALTH, LYNTON AND  
DISTRICT (DEVON)



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## PREFACE

THIS book has been written at the request of many of my friends, and particularly those in the medical profession, who, desiring more practical knowledge of the subject, were unable to obtain any book dealing with it in a concise practical manner. It is for them to say whether my object has been attained.

As this work has been written principally for the General Practitioner, I have curtailed the opening chapters as much as possible to enable me to give more space to what I consider the important practical parts of such a subject, and at the same time to keep the book to a moderate size. Although I know that a busy practitioner's leisure for study is limited, I have felt it necessary to deal at some length with matters which, as far as I know, have not been treated hitherto as seriously as they deserve.

The chapters on protected glasses, elements, and electrodes have been compiled with the greatest care and attention to detail, and it is hoped that they may be of assistance to those who cannot themselves expend the time for such research work. In the chapter on lamps I have avoided a multiplicity of designs, in the hope that those starting may be able to find one suitable to their requirements among the many illustrated. If their armamentarium is to consist of only one lamp at first, let me advise them to select a tungsten, following it up later with one of the mercury vapour variety.

Although my views on dosage may be slightly at variance with those of other writers, perhaps they may



admit that, in the light of my individual experience, I cannot entirely agree with some of the theories published on this subject.

To those whom this book may possibly help in acquiring a knowledge of ultra-violet ray, and who are contemplating starting this branch of medical science in their practice, let me express the hope that they will be prepared to give both time and patience to it, otherwise the results can only give dissatisfaction both to patient and doctor.

I should like here to express my deep gratitude to all those who have helped me in compiling this little book; to the friends who assisted in the experiments, to those who so generously lent the blocks for the illustrations, to the publishers for their courtesy to me throughout the printing of the book, and last but not least, for many kindly hints obtained from my friends when reading through the proofs. I am indebted to them all.

H. G. FALKNER.

20, PARK CRESCENT,  
LONDON, W.1.  
*June, 1927.*

## CONTENTS

CHAPTER	PAGE
INTRODUCTION . . . . .	I
I. HISTORICAL . . . . .	5
II. NATURAL SUNLIGHT . . . . .	10
III. ARTIFICIAL ULTRA-VIOLET . . . . .	13
IV. LAMPS . . . . .	19
V. SPECTRUM . . . . .	35
VI. DETECTION AND MEASUREMENT OF ULTRA-VIOLET WAVE-LENGTH . . . . .	39
VII. ELEMENTS AND ELECTRODES . . . . .	43
VIII. QUARTZ AND GLASS . . . . .	50
IX. DOSAGE . . . . .	57
X. TECHNIQUE . . . . .	59
XI. TREATMENT IN GENERAL . . . . .	77
XII. SKIN DISEASES . . . . .	81
XIII. TUBERCULOSIS AND LUPUS . . . . .	105
XIV. DISORDERS OF NUTRITION . . . . .	110
XV. DISORDERS OF THE RESPIRATORY SYSTEM . . . . .	118
XVI. DISEASES OF THE NOSE, MOUTH, AND THROAT . . . . .	121
XVII. DISORDERS OF THE ALIMENTARY SYSTEM . . . . .	125
XVIII. GENITO-URINARY SYSTEM . . . . .	127
XIX. CIRCULATORY SYSTEM—HIGH BLOOD PRESSURE . . . . .	131



CHAPTER	PAGE
XX. DISEASES OF THE BLOOD AND DUCTLESS GLANDS . . . . .	133
XXI. DISEASES OF THE EAR . . . . .	135
XXII. DISEASES OF THE EYE . . . . .	137
XXIII. SUMMARY OF DISEASES . . . . .	140
INDEX . . . . .	147

## ILLUSTRATIONS

FIG.	PAGE
1. Sunlight Department in a London Hospital . . . . . <i>facing</i>	12
2. Spectra of different Sources of Light . . . . . "	16
3. A Bright Corner in St. Mary's Hospital, Paddington . . . . . "	18
4 & 5. Tungsten Arc Lamp, fitted with tungsten, carbon, or steel	20
6 & 7. Author's Lamp for Local Treatment and Dental Work . . . . .	22
8. Author's Lamp for General Radiation . . . . .	23
9. Kromayer Water-cooled Lamp . . . . .	25
10. "Sunray," White Flame, 30 amp., Automatic Feed, open flaming Carbon Lamp (Cox-Cavendish Co.) . . . . .	26
11. Author's Raying Room, showing large and small lamps for local work, with shield for inhalation . . . . . <i>facing</i>	26
12. Round Radiant Lamp . . . . .	28
13. Jesionck Lamp . . . . . <i>facing</i>	28
14. Quartz Mercury Spectrum . . . . . "	28
15. "Alps" Model Portable Quartz Mercury Vapour Lamp . . . . .	30
16. Sunic Tungsten Arc Lamp . . . . . <i>facing</i>	30
17. Multiple-Carbon Arc Lamp . . . . . "	30
18. Apex Lamp . . . . . "	32
19. The Heliol Lamp . . . . . "	34
20. Uvral Apparatus . . . . . "	34
21. The Expometer . . . . . "	34
22. Actinoscope . . . . .	41
23. Adam Hilger Quartz Spectroscope, with Uranium Screen <i>facing</i>	42
24. (1) Tungsten Square. (2) Tungsten Round. (3) Steel. (4) Cored Carbons. (5) Plain Carbon. (6) Metallium and Plain Carbon. (7) Metallium . . . . . <i>facing</i>	44
25. Photographs from the National Physical Laboratory . . . . . "	48
26. Glass Transmission of Ultra-violet . . . . . "	54
27. Glass Transmission of Ultra-violet . . . . . "	54
28. Wellsworth Hardy Goggle. Pfund gold-plated Lenses . . . . . "	56
29. Wellsworth Model 444. Saniweld Lenses . . . . . "	56



FIG.		PAGE
30.	Fleming Model, "Absorbo" . . . . . <i>facing</i>	56
31.	Fleming Model, "Absorbo," suitable for infants . . . . . "	56
32 & 33.	Model 500 Face Mask . . . . . "	56
34.	Irradiation with small Local Lamp (gums, tonsils, etc.) . . . . . "	72
35.	General Irradiation with Author's Lamp . . . . . "	88
36.	General Irradiation with Mercury Vapour Lamp . . . . . "	104

## ACTINOTHERAPY

### INTRODUCTION

THE general practitioner, to whom the subject of actinotherapy is an unexplored field, will, it is hoped, find in this work a handbook which will serve not only to introduce him to the subject but also to guide him in the matter of apparatus. That there is a need for such a book all will agree, and as the author writes from his own experience the advice he is able to give has in all cases passed the test of repeated personal trial and research.

All the experiments recorded have been performed in his own treatment rooms under careful supervision, and each one has been checked many times to ensure its accuracy. It will not be out of place to mention here that the writer could not have made these experiments without the help of Mr. R. Grange, M.Inst.Brit.F., F.I.O.

Now that the ultra-violet ray has such a vogue, nearly every instrument maker in the kingdom has his own special lamp upon the market, many of which are not suitable for general practice. It therefore becomes more necessary for the beginner to be particularly careful in selecting a suitable lamp for his purpose, otherwise he may be led into useless expenditure for an installation which in all probability will be valueless to him. It may not be adapted to his electric current, or it may be too powerful, very expensive to purchase



and maintain, and what is very important, each treatment may necessitate too much time.

Another very necessary point is to obtain the required technique, and the knowledge of the cases that are likely to give the best results. It must be remembered that no therapeutic agent is infallible, and any new method of curing is likely to be brought into bad repute by its adherents claiming that everything can be cured by it.

The laity have had many opportunities of reading in the press statements of a true and false nature concerning the wonderful results obtained with the ultra-violet ray, and that it can be easily administered with a suitable lamp in their own homes. A number of people have been led to install such lamps, with no knowledge of how to use them.

The writer cannot too strongly condemn this practice, and maintains that no treatment should be given in the home with any make of lamp, unless under expert medical supervision, and with a skilled attendant present. Should an unattended patient fall asleep for an hour or so under the ray, which is very probable, serious damage may be done. The writer has known several cases of this actually happening. A patient told him that she had obtained a lamp, and without any knowledge of dosage, gave herself one or two hours' consecutive treatment, which was highly dangerous.

This ray has a marked bactericidal effect on wounds, and chronic ulcers that resist all other treatments respond in a very gratifying way to it.

The writer well remembers a patient from Southampton who consulted him about a gangrenous varicose ulcer on her ankle, which was giving her considerable pain, and had resisted every other treatment. Within a fortnight of commencing treatment with ultra-violet ray, a wonderful change had taken place. All pain had disappeared, sloughing had almost ceased, and healthy granulations were forming. Eventually healing and complete recovery took place.

Success, however, cannot be assured in every case, and in one instance an ulcer very similar to the above entirely failed to respond to this treatment.

As a tonic after a wasting disease such as influenza, etc., one may safely say there is nothing to equal these ultra-violet rays. They do more good than drugs, and for increasing the hæmoglobin and white blood corpuscles, no medicines can equal them. The blood of patients has been counted before, during, and after treatment, and it has been noted that there was an almost incredible increase in the hæmoglobin and white blood corpuscles.

Perhaps the most remarkable success of this treatment is in the case of rickets in children. To watch these poor, weedy youngsters gaining health almost daily is compensation for any failures one may experience.

Hyperpiesis cases, which resist all ordinary medicinal treatment, invariably respond to ultra-violet ray. One must not exclude all other methods of treatment for the ultra-violet rays. Combined, for example, with the permanganate of potassium and thyroid treatment of Dr. Nott—a combination I have tried in many cases with most satisfactory results, especially in skin cases (see chapter on skin diseases and eczema)—I have arrived at the conclusion that the one greatly aids the other, with dieting and possibly some other drugs included.

The giving of ultra-violet ray need not necessarily be confined to the specialist. The general practitioner, with the required knowledge and apparatus to suit him, should obtain wonderful results, but he must be prepared to give the necessary time and attention to this work. Another important item—he should not look for results after only one or two treatments. If a patient should report a wonderful improvement after a few treatments, he should not discontinue at this stage, otherwise the patient would relapse into his former condition, and naturally lose confidence in



the ultra-violet ray. It should be thoroughly explained to the patient that a course of not less than six treatments will be needed to do any permanent good, the number required depending upon the ailment and individuality of the case. Whilst treating patients with artificial ray, instil into their minds the great help that open air and sunlight is to them. If living in a smoky town, insist that they should get out into the pure air of the country, and take either walking or golfing exercise, if they are able to do so.

One never feels so well as after a good round of golf, with the necessary fresh air, and exercise for every muscle in the body.

Tennis is another form of exercise which is excellent—but only for the young. For those getting on in life, it tends to become too strenuous.

The form of apparatus necessary, and the technique, will be gone into fully later on, and need not be stressed here.

## CHAPTER I

### HISTORICAL

Heliotherapy in early times—Sun treatment—The merging of ultra-violet into X-ray—Effect of heliotherapy on bone diseases—Bernhard of Samaden, and the action of sunlight on meat.

FOR many years now, ultra-violet ray has been known to scientists and the medical profession, yet it is astonishing how little this ray has been utilised by the profession. Indeed, until the war, it was only used here and there for a few skin cases.

About the middle of the war it was sprung on the profession as a wonderful method of healing wounds, and for a long time it was spoken of as the "mysterious method" of killing the microbes in wounds, but no one seemed to arrive at what this new method was. When the little bubble burst, it was our old friend the ultra-violet ray. An old friend it undoubtedly is. Look back into past literature, and you will see that as early as the seventeenth century, the solar ray was utilised in medical treatment, and yet there are doctors to-day who speak of it with contempt as one of these new methods introduced into medicine. I have even heard the term "quack medicine" applied to it. There are now, fortunately, a great many people of not quite such a sceptical turn of mind, who see the great help it is to doctors, in their daily round of endeavour to cure the ills that flesh is heir to.

Heliotherapy was used for the curing of disease from the earliest times. It was practised by the ancient Romans, Greeks, and Egyptians, and it would not be at all surprising



if the latter were better informed about it than we are to-day. During the Dark Ages, as they were called, it seems to have passed out of use or been quite forgotten, and it was only in the latter end of the eighteenth century that it came into use again.

Rollier gives an interesting account of heliotherapy in his book, mentioning that Faure in 1774, and Bertrand in 1779, both used the solar ray for curing certain diseases. Again, in 1815 Loebel used it extensively. Drs. Russell and Russell mentioned in their book that Downes and Blunt in 1877 used it for its bactericidal properties, so we see that it is by no means what might be called a new aid to medicine.

It was left to Sir Isaac Newton, with the discovery of the spectroscope, to revolutionise ultra-violet ray, by opening up the invisible ray's energy, and indirectly the artificial therapeutic rays. Ultra-violet ray is invisible to the naked eye, and it is only by the spectrum that we are able to tell what ray is given off.

It is also by the spectrum that we are able to judge of the quality of the ray—that is, the length of wave, because ultra-violet rays extend from 4000 Å.U.\* to close upon 1850 Å.U., and it is not all ultra-violet metals that give the same wave-length nor the richness of ultra-violet ray. This will be explained later on. In Leysin, up in the Swiss Alps, Rollier can utilise the sun's rays the whole year round. Even when the snow is on the ground it makes no difference. It is in fact, beneficial, because it has been found that snow has a very high percentage of reflective power. It was in 1903 that Rollier opened his clinic for the treatment of tuberculosis of bones, glands, etc., since when he has had some brilliant results. Here in England, Sir Henry Gauvain opened a similar clinic at Alton and Hayling Island, and notwithstanding the difficulties he has had to contend with in our climate, he has obtained highly satisfactory results, but

\* Å.U., Ångstrom unit, one ten-millionth part of a millimetre.

found that if it had not been for the artificial ultra-violet ray, he could never have achieved these good results.

We must not forget that although the sun gives a small percentage (7 per cent.) of actinic or ultra-violet ray, as it is called, it also gives other rays which are not always health-giving, and cannot be cut off in the same way as the artificial rays by interposing different screens.

In 1893 Professor Finsen of Copenhagen experimented with his light system on tuberculous disorders, and obtained wonderful success, but the great objection to his system is that, owing to the size and cost of the lamps, only very few hospitals were able to install them, and in latter years have given them up. The late Queen Alexandra took a great interest in this lamp, and had it installed at the London Hospital.

Peter Cooper Hewitt, by using thallium and caesium in the construction of quartz mercury arcs, greatly increased the output of ultra-violet radiation, which naturally gave a great impetus to this work, much reducing the cost of production per treatment.

But we must not forget that it is to Isaac Newton, the discoverer of the spectrum, to whom we owe this advance in ultra-violet ray, for without the spectrum to show what ray the different metals are giving, little could be done. Those not versed in this work can very easily be misled, for when the lamp is burning, a beautiful blue light is given off. This colour, of course, has nothing to do with the actual ultra-violet ray owing to its invisibility, and it is only by testing the ray with a spectroscope that we actually see the wave-length.

**Merging of Ultra-Violet into X-ray.**—As to when the ultra-violet wave actually merges into the radium or X-ray wave is an exceedingly interesting point. In fact, it must be very near, for in treating a patient with my big raying lamp, he brought to my notice that he could see the bones of his



foot reflected on the wall "like the X-ray," as he described it. On testing this phenomenon and throwing a shadow upon the white wall, it was found that the bones of the arm, forearm, and hand were distinctly visible. In the leg they were likewise visible up to the knee, but when it came to the thigh no tracings could be noted.

This goes to prove that we are very near the X-ray waves, if not encroaching upon them. However, for medical purposes we have no interest in these short waves. It is not until we reach 1850 Å.U. to 1900 Å.U. that they are useful to us.

In 1895 X-ray was discovered by Röntgen. This was held to be due to radiations of short wave-lengths, and we may presume that the gap between these radiations and the ultra-violet is small, as the experiment illustrated above would go to show that one practically merges into the other.

**Effect of Heliotherapy on Bone Disease.**—The specific action of heliotherapy on tubercular bone disease and osteo-arthritis was specially referred to by Bonnet in 1845. This author strongly recommended the general as well as local heliotherapy treatment upon these cases. Lebert and Türck also recommended this treatment (Rollier), and Arnold Rickli, although not a medical man, evidently knew the great value of the sun's rays, and opened a clinic at Veldes in Austria. Again, in 1859, Charcot showed that the application of the sun's rays is independent of any heating action. In 1902, Bernhard of Samaden noted that in a high mountainous atmosphere, putrefaction did not take place in meat exposed to the action of the sun. He started to treat operation wounds with direct exposure to the sun, with the greatest benefit.

This all goes to show that ultra-violet ray treatment, so far from being of recent origin, really dates far back to the forgotten ages, and that since the artificial means of obtaining the ultra-violet ray has become known, it has gone forward

rapidly and has now become one of the recognised methods of treating disease.

Ultra-violet ray is a very pleasant treatment, and besides curing disease, it gives a bronzing to the skin which is greatly appreciated by many people. Only the other day the author was much amused when a patient, a hard-headed Scot, said, "I tell you what, doctor: you should bring this ray of yours up to the north of Scotland in the summer. You would make your fortune by browning the knees of those Sassenachs who by donning the Highland costume, want to ape the Scot, but are given away by their beautiful white knees!"



## CHAPTER II

### NATURAL SUNLIGHT

Atmosphere with regard to sunlight—Climatic difficulties—Action of sunlight on skin—Artificial *versus* natural sunlight.

THE actinic or ultra-violet ray from the sun has been used for many centuries. Therapeutically it matters little where the ray comes from, or what it is, still there are people who like to know the why and wherefore of things.

Dr. Russell mentions in his book that "of solar radiation, only a two-billionth part is intercepted by the earth, and that only six-tenths of this amount passes through the earth's atmosphere." Therefore in order that any benefits can be obtained from this source, we can see how absolutely necessary it is that patients should be in a clear atmosphere, free from all the smoke and dust that we get in large towns, and that if we expect them to benefit from this ray, they should be in the country, if possible at a high altitude. Although most of those practising this work are not so particular about this latter point, the smoke and dust act as a screen at the lower levels we have to contend with.

Again, medical men are in slight controversy as to whether natural or artificial sunlight is best.

Dr. Leonard Hill, who has gone into this matter very scientifically, is strongly in favour of the pure sunlight, but one must look at this in a practical manner, and take into account all the points for and against it.

**Climatic Difficulties.**—Unfortunately, England is a

### NATURAL SUNLIGHT

II

country where we get extremely little natural sunlight, and there are practically only two months in the year—July and August—that the maximum range of ultra-violet ray, as shown by the spectrum, is usually found. In summer, the sun's rays reach their greatest maximum of intensity round about one o'clock p.m., and therefore the greatest intensity of the short wave-lengths. At the same time the ultra-violet ray intensity is supposed to remain fairly constant from April to September. From October to April considerable variations occur, as is to be expected. In July and August the calorific radiation is very great—greater than in any other months of the year, and probably greater than the ultra-violet ray given off.

Some opinions maintain that diffused light gives off more ultra-violet than any one imagines, and that short wave-lengths are more easily diffused than the longer ones.

In winter the sun gives out its smallest amount of ultra-violet ray, and it is found that there is then a considerable difference of ultra-violet radiation between the high altitudes and the low. It stands to reason that the greatest amount of this will be found in the higher altitudes in the winter, but most authorities are inclined to think that it makes little difference in summer. However, one cannot help thinking that contact with the dust, smoke, and possibly fog, must have some deleterious effect on the sun's rays at the lower levels. Rollier, who we may say is one of the greatest living authorities on treatment by solar rays, states that "the sun and ultra-violet rays bear much the same relation to one another as crude drugs do to their synthetically prepared chemical substitutes." We must remember that the sun's rays up in the Alps are vastly different from those in any part of England. In the Alps, except for fogs, the sun has not its natural enemies, smoke and dust, to contend with as it has in the valleys and cities. At the best of times the sun gives off only 7 per cent. of ultra-violet ray, and how much of



this is cut off when it reaches England, by impurities in the dust-laden atmosphere !

**Action of Sunlight on Skin.**—When a patient is exposed to a hot sun, redness or erythema of the skin takes place, and after a few days the skin peels. If exposure to the sun's rays is continued "sunburn" or pigmentation gradually supervenes. This is Nature's defence against absorption by the body of too much ultra-violet ray. This redness or erythema, which may go as far as blistering, causes for the time unpleasantness and pain. It should be explained to patients that no contractions occur, such as result from burns by radiant heat or X-ray, and that as a matter of fact the skin is greatly benefited. This is apparently a small matter, but one that if not very carefully explained may result in losing the patient, particularly if a woman, as some are extremely sensitive about their skin.

There is a big difference between sunlight and artificial rays. In the former there are all the rays of the spectrum ; in the latter the preponderance of ultra-violet ray, but there is also infra-red in a larger or smaller degree. The carbon arcs are supposed to be the nearest approach in artificial rays to the sun's rays ; that is to say, there are ultra-violet rays, infra-red, and the other colours of the spectrum. In sunlight it is very difficult to screen off the other rays of the spectrum leaving only the ultra-violet radiation, but in artificial this can be done.

As mentioned before, not all the rays from the sun are beneficial ; some are far from being so, therefore in prescribing the sun's rays, always do so very cautiously, and increase your dose gradually. Some doctors begin on the legs, following with the thighs, and working up to a whole body bath. This method is followed and favoured by Professor Leonard Hill.

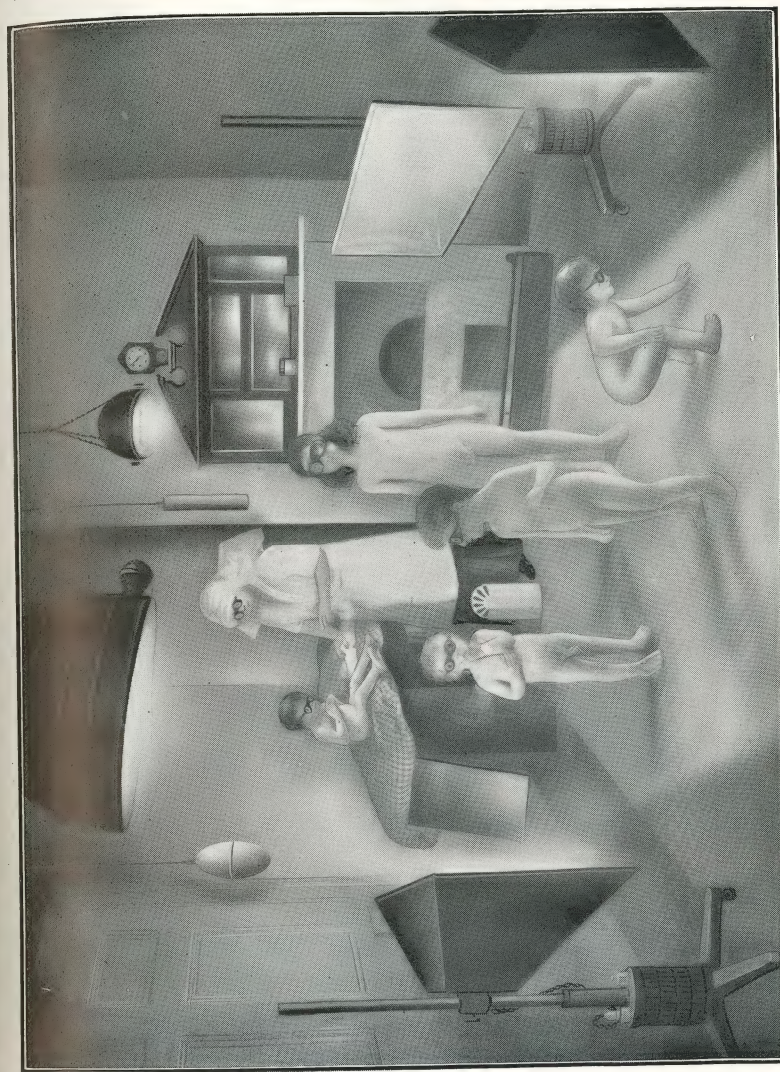


FIG. 1.—Sunlight Department in a London Hospital.

[To face p. 12.]



## CHAPTER III

### ARTIFICIAL ULTRA-VIOLET

Arc lamps—Effect of glass on the ray—Action of ultra-violet on the body—Advantages in time for treatment—Natural sun-baths—Necessity of testing—Effects on patients—Open arc lamps.

As mentioned previously, in England it is almost impossible to practise heliotherapy owing to climatic circumstances—moisture and smoke-laden atmosphere, the latter acting as a screen and hindering to an enormous extent the actinic radiation of the sun. It therefore follows that in unfavoured countries we have to rely on artificial radiation to do the valuable work of the sun, our three sources of ultra-violet ray being electric, incandescent, and arc lamps.

### ARC LAMPS

**Arc lamps** may be divided into two groups; closed and open arcs.

*An open arc* is formed by the passing of an electric current between two terminals, the result producing an intense illumination, according to the electrode used. This illumination is composed of invisible ultra-violet ray, and visible rays such as red, orange, yellow, green, blue, indigo, and violet. The radiation given off by these lamps is comparatively cold, whereas some generate a fairly intense heat, and care has to be taken not to burn the patient.

*Closed lamps* comprise mercury vapour, which again can be divided into :



1. *Air-cooled lamps*.—Those in which the arc is struck
  - (a) in vacuum,
  - (b) in argon,
  - (c) at atmospheric pressure.
2. *Water-cooled lamps*.

The incandescent or light baths act as one of our important sources of generating heat. They have been found most useful, not only in helping ultra-violet radiation, but as an additional means of healing in certain recognised diseases such as the rheumatoid variety, neuritis, gout, and many others. But their best use is in dilating the capillaries of the skin and stimulating the sweat glands. Internal congestion is relieved and pain lessened. The patient will remark that a general feeling of comfort pervades the body while under them.

**Effect of Glass on Ray.**—However, it must be remembered that although a certain amount of ultra-violet ray is given off by a filament lamp (about 1 per cent.), the glass will stop most of this, and the quantity given off is so small that it is not worth while substituting a quartz bulb for glass, now that there are so many other recognised lamps on the market for obtaining ultra-violet ray.

A glass called Vitaglass has been recently invented, which allows a certain proportion of actinic ray to pass through it. Possibly in the near future, we shall see incandescent bulbs made of this glass. It would certainly be safer than some of the ultra-violet ray lamps now being recommended to the laity.

However, high-powered incandescent lamps of, say, 2,000 candle-power have their own uses irrespective of any ultra-violet they may throw out. A lamp of the above candle-power gives an intense radiant heat. Before giving an ultra-violet ray bath, the patient should lie from ten to fifteen minutes under such a lamp so as to dilate the surface capillaries. By bringing more blood to the surface, a larger area of blood is brought into contact with the ultra-violet radiation, thus effecting better results. Also in cases of

rheumatism, arthritis, and acute lumbago, the deep-seated congestion is relieved, thus forming a therapeutic agent to the patient.

There are many rays in the solar spectrum not only not needed for therapeutic use, but harmful as well. In artificial actinotherapy we can get an accuracy of dosage, which cannot be obtained in sunlight in this country, and those rays not needed can be screened off.

**Advantage in Time.**—Another point in artificial sunlight is that the ultra-violet ray is so much more powerful, and the treatment can be given in a shorter time. This, to some business men and women, is a great asset; and, further, we are not confined to any particular time of day—morning, afternoon, or evening are equally suitable. In dealing with pure sunlight, this does not hold good, as the seasons and time of day must all be taken into account. By this we do not mean to say that an artificial sun-bath is superior to the natural sun-bath such as is to be had at Leysin or other beautiful places abroad, where the sun pours down all day in a pure atmosphere with or without altitude. Under conditions like these, by all means have a natural sun-bath; but how many people can afford to have their sun treatment under such perfect circumstances? For those who must stay in England all the year round, artificial radiation is always preferable, because it is only in July and August (and only then possibly on certain days) that conditions are conducive to the best results for ultra-violet ray.

Having lamps of the latest design, capable operators who possess the requisite knowledge, and medical men who do not think they can perform miracles with ultra-violet ray, and who are willing to use the ray as a means of aid with other methods of treatment, should lead to gratifying results both to themselves and their patients. On the other hand, those workers in ultra-violet ray who use it as a "cure all" will have great disappointments occasionally.



**Necessity of Testing.**—Don't be afraid to test the urine, eyes, blood, etc. ; if necessary, have an X-ray examination, and use every known method of diagnosis and treatment, as well as the ultra-violet rays, to help the patient. Then good results may be expected.

Men like Sir Henry Gauvain, in his work at Alton, found that until they used the artificial rays, they could not obtain the same results as Rollier in the Higher Alps. Notwithstanding the progress made in this work in the last few years, we are still only on the fringe of what will be known about it in the future. It is not only by laboratory work, but by a combination of the scientist and the clinician working together that we shall get results. Both are necessary to each other if we are to attain any lasting benefit in this ray.

**Effects on Patients.**—Ultra-violet ray acts differently on patients ; it stimulates some, and they feel the immediate benefit ; in others it has a suppurific effect. Good results are obtained on nearly every patient, but with those suffering from diabetes, lung tuberculosis, cancer, etc., only a toning-up effect can be expected. The ultra-violet ray has also an accumulative result, and the good effects are felt for many months after treatment has ceased. Until we really know more about this ray, many things will be difficult to understand ; we must work upon results and watch the effects.

How does the taking of medicine really cure a patient ? We know by experience that certain drugs act upon a disease. By constantly watching their effect upon that disease, we get a fairly consistent result. We are still in the dark as to how it really acts, notwithstanding all that science has taught us ; so that we cannot expect to know everything about ultra-violet ray for some time yet, though each day teaches us something.

**Open Arc Lamps.**—The carbon arc lamp is sometimes preferred for general baths when giving artificial radiation. This ray contains a large quantity of infra-red, and a fair

Wave-lengths in millimicrons ( $1\mu\mu$  equals  $10^{\circ}$  Ångström units).

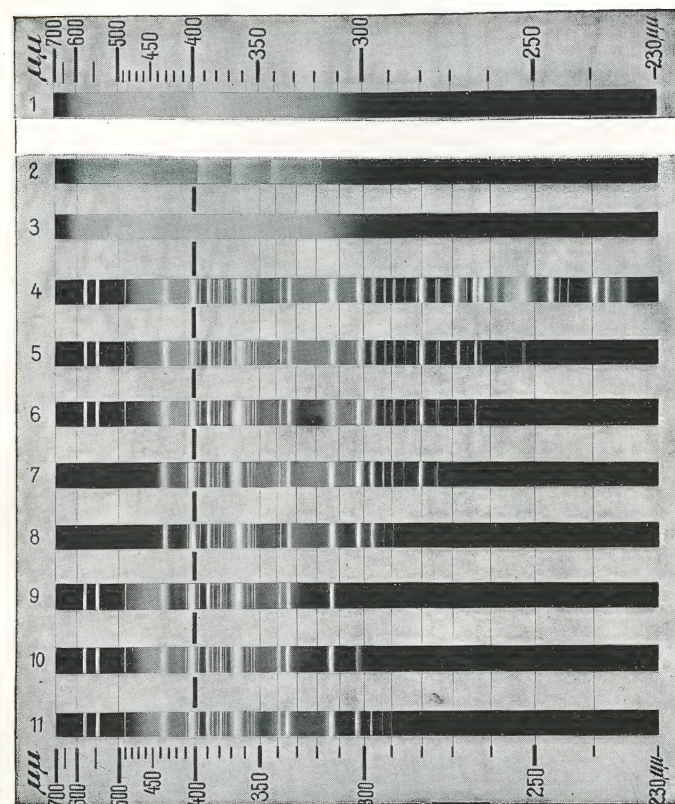


FIG. 2.—Spectra of different Sources of Light.

1. Sunlight (at sea level). 2. Carbon Arc Lamp. 3. Sollux Lamp (Tungsten filament). 4. "Artificial Alpine Sun" Quartz Lamp (without filter). 5. "Artificial Alpine Sun" Quartz Lamp through 1.3 mm. white Uviol glass. 6. "Artificial Alpine Sun" Quartz Lamp through 2.6 mm. white Uviol glass. 7. "Artificial Alpine Sun" Quartz Lamp through 1.3 mm. blue Uviol glass. 8. "Artificial Alpine Sun" Quartz Lamp through 2.6 mm. blue Uviol glass. 9. "Artificial Alpine Sun" Quartz Lamp through thin window glass (1 mm.). 10. "Artificial Alpine Sun" Quartz Lamp through 0.25 mm. celluloid sheet. 11. "Artificial Alpine Sun" Quartz Lamp through 0.05 mm. mica sheet.

[To face p. 16,



quantity of ultra-violet ray. It also gives off radiant heat, which is a help to patients. If a general carbon bath is given, and a tungsten local radiation, very good results may be obtained. There is abundant evidence to prove that if a bath and local treatment be given together, the result is far better than when given separately. Carbon lamps with a varying consumption of 25 to 75 amperes may be used; if only one or two patients require the bath, a lamp of 25 amperes is sufficient. The patient can lie or sit, starting with a ten-minute dose and working up to an hour, the distance varying from 2 to 4 feet. For a larger number of patients the lamp of greater amperage should be used.

Over twenty years ago this form of lamp was established in one of our big London hospitals with very great success, especially in lupus cases. The Finsen lamp, which was the pioneer of this type, can only be fitted up at very great cost, and the space required is considerable, therefore very few could adopt it.

Direct current should be used with these lamps, because a crater is formed on the positive terminal, the most intense radiation coming from this side. If the alternating current is used, the crater is formed upon each carbon, and the intensity of ultra-violet radiation decreases. An important point in the writer's lamp, is that it is so constructed that it can be raised or lowered at will. The patients can lie on a comfortable couch, and need not be nearer the lamp than 18 to 24 inches. It gives them carbon, tungsten, or metallium separately, and as stated before, it does not necessitate moving the patient.

There are many carbon lamps on the market, some of them very good. It is only a matter of suiting the lamp to the treatment-room or the class of work intended. Some are suspended in a framework containing two or three arcs. So arranged, two or three patients can be treated at will, recumbent or otherwise. This form of lamp is



more suitable for hospital or clinic work than for private practice, where only one patient at a time is treated with any one lamp.

The writer knows of a lamp of which the design is that of the original street lamp used many years ago, but it is not one to be recommended, it having to be suspended more or less over the patient. No lamp should be so, for if a lamp were to break, or hot carbon fall on the patient, an ugly burn would be the result, with possible damages against the doctor. Therefore, it is always wise to keep the lamp well away from the patient, in order to avoid accidents.

A very good carbon arc lamp is made by Messrs. Watson & Sons. It consists of four carbons above and four below, so that they hang vertically over one another, the positive on top. Everything is arranged upon a marble stand, which contains the mechanism to keep the carbons apart. Two such lamps, one in front and one behind the patient, answer very well. However, this lamp is for a hospital or clinic rather than a doctor's treatment-room, and the patients have to sit up, which to some of them is an objection. Its great advantage is that only a small resistance is required, which makes for economy in upkeep.

In starting with a ten- to fifteen-minute exposure, at a distance of 3 to 4 feet, increasing by three minutes per treatment, and possibly working up to an hour or more, treatment with these lamps means time, and patients should be warned of this, or they will object. However, if fully explained to them, there will rarely be any trouble.

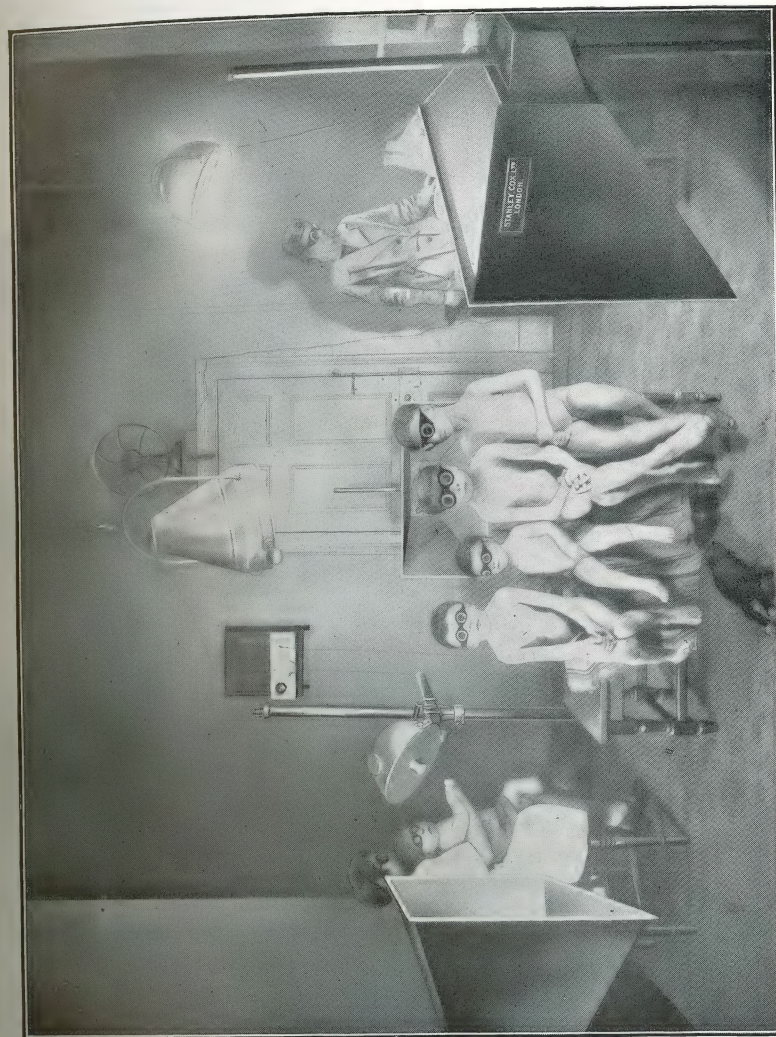


FIG. 3.—Showing a bright corner in St. Mary's Hospital, Paddington, London.

[To face p. 18.



## CHAPTER IV

### LAMPS

Tungsten arc lamp—Falkner tungsten arc lamp—Tungsten carbon arc lamp—Kromaye water-cooled lamp—Sunray carbon arc lamp—Radiant heat lamp—Jesionck lamp—Quartz mercury vapour lamp—Mercury vapour lamp—"Alps" model mercury vapour lamp—Sunric tungsten arc lamp—Multiple carbon arc lamp—Apex lamp—Heliol lamp—Uvral automatically controlled apparatus—Expometer.

THE choice of the most suitable type of lamp to meet any particular requirements, is in most cases extremely difficult for the purchaser. There are a great number of excellent lamps on the market, and as a rule it is quite safe to put oneself in the hands of a reputable firm manufacturing or dealing in these lamps. There are two types of lamps suitable for the practitioner: open arc lamps and closed arc amps. The open arc lamp usually has electrodes of tungsten, steel, carbon, or an impregnated carbon. A most important fact to remember, is that no lamp has any advantage regarding the quality or quantity of ultra-violet rays. The controlling factors are the electrodes, the amount of current, and the voltage across the arc. The only advantage that one make of lamp can have over another, providing the current consumption is the same, is its convenience in use, its movements, its adaptability for local and general radiation, etc.

**Striking the Arc.**—If those who do not understand what this signifies will refer to pages 24 and 29, full details will be found.

**Tungsten Arc Lamp** (Figs. 4 and 5). (Suitable for both



local and general radiation.)—This lamp is equipped with close-fitting doors, which are opened for general radiation, and closed for local. The doors are fitted with a holder, into which

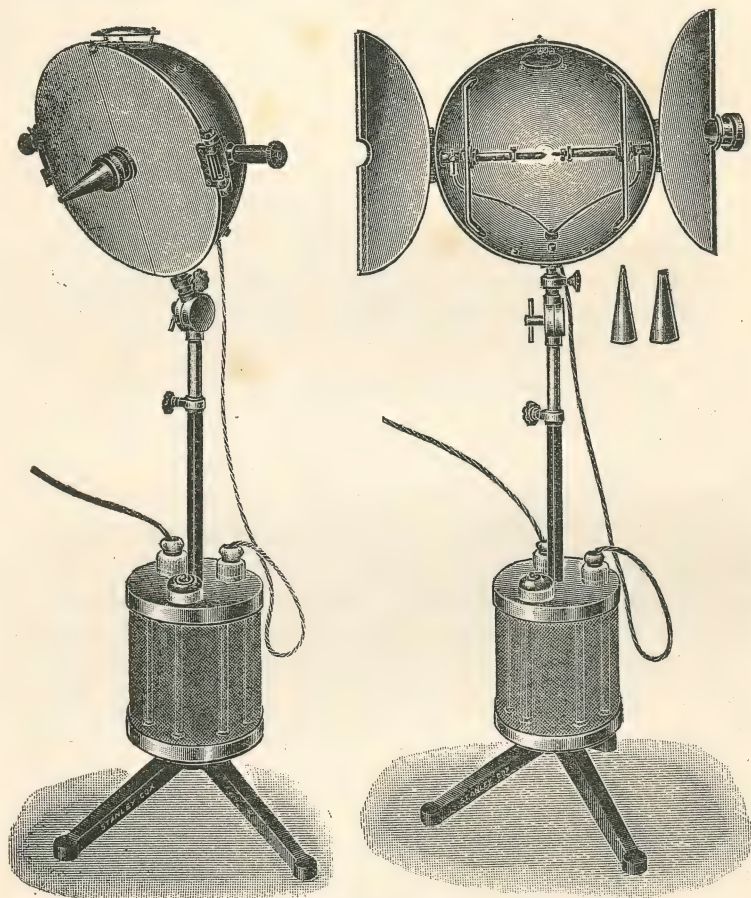


FIG. 4.

FIG. 5.

Tungsten Arc Lamp, fitted with Tungsten, Carbon, or Steel.

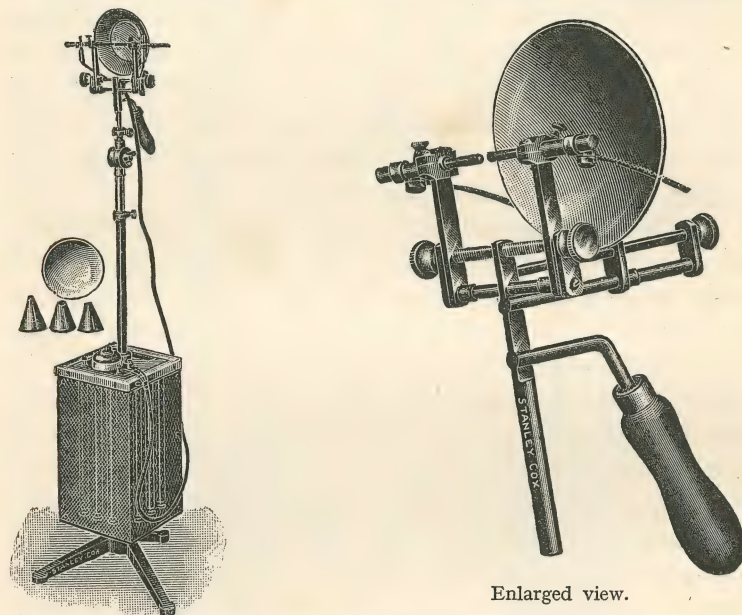
a quartz lens may be inserted for focussing the light to a pin-point to treat any part of the body; this is generally used only for small areas. This lamp is very compact and easily

worked, and either tungsten, metallium, or carbon may be used in it. The resistance has been arranged round the stand, so that the lamp may be moved to any part of a room, or from room to room if desired. The lamp portion is fitted on an angling joint, thus allowing the lamp to be tilted to any required position. There is nothing to go wrong, no complicated mechanism, and when burning, needs only a half-turn of the electrodes to the right, so as to keep the points the required distance apart. This should be done about every fifteen minutes. It can be used for every kind of local and general treatment, and is therefore convenient for the general practitioner's rooms, or for the home, providing the treatment is carried out under skilled supervision.

**Author's Tungsten Arc Lamp** (Figs. 6 and 7).—This lamp has been designed for local work only, and if kept to this work, it has many advantages over any lamp at present on the market. It is fitted on a stand, with the necessary resistance round the base, and has been so designed that it may be lifted off the stand and held in the operator's hand, to facilitate the raying of any part of the patient's body. The electrodes are tungsten, but there is no reason why metallium should not be used. Metallium electrodes are designed to fit this lamp, which weighs under two pounds, and is easy to manipulate when treating the gums, throat, ears, or any small area. By altering the position of the reflector, *i.e.* by bringing it nearer or farther away from the electrodes with a milled handle at the back of the lamp, the beam of ultra-violet ray can be focussed to 2 inches in diameter, or reduced to the size of a sixpence. By manipulating the milled handle, the points of the electrodes can be approached or receded at will. It may be stated here that the best distance apart for the electrodes, after the arc is struck, is about  $\frac{1}{4}$  inch. It has been found by experiment that the greatest quantity of ultra-violet ray is given off when about that distance is maintained; this refers to any arc lamp when fitted with



either tungsten or metallium. The resistance is so constructed that when the arc is struck, not more than 3 amps. are used; there is no reason, therefore, why it should not be fitted to the ordinary plugs for household lighting. Furthermore, the resistance may be removed from the stand, and it and the lamp taken to a patient's house for use by the practitioner. Heavy work should not be attempted



FIGS. 6 and 7.—The Author's Lamp for Local Treatment and Dental Work.

with this lamp; there is another more suitable for the purpose (Fig. 11). If the author's lamp is kept to the lighter work, the writer thinks that it will be found that it is light, handy, and easy to manipulate.

He has been informed by Mr. Stanley Cox that cones 6 inches or more in length, with or without tongue depressor, and of varying diameters, have been put on the market to suit those who find it difficult to direct the ray to the tonsils

or any part of the gums. However, if the lamp is properly elevated and focussed, no difficulty should be found in directing the ray to any part of the body, whether in the mouth, nose, or vagina, etc. Care should be taken that the

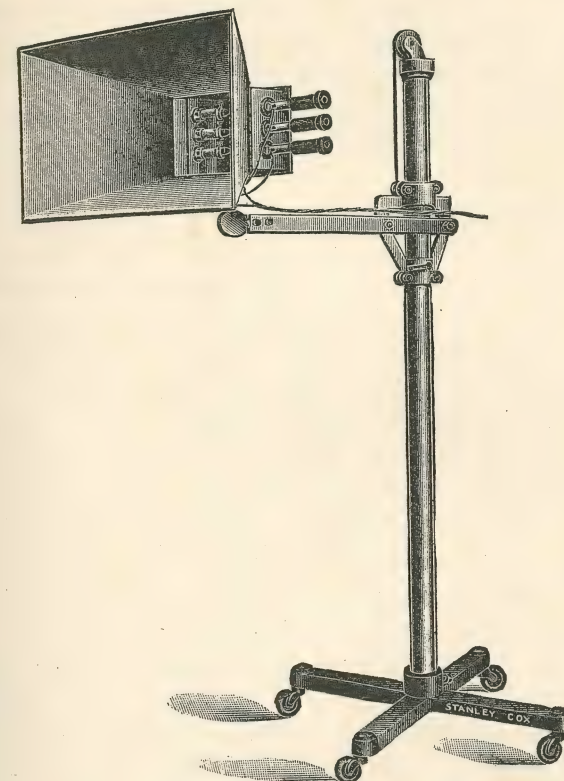


FIG. 8.—Author's Lamp for General Radiation.

point where the arc is struck, is always exactly opposite the centre of the reflector.

**Author's Tungsten Carbon Arc Lamp** (Fig. 8).—The writer has felt that a lamp was badly needed, capable of producing carbon or tungsten rays at will, without disturbing the patient, therefore this lamp was manufactured to give both



carbon and tungsten radiation, separately or together, and is designed for general work only. It consists of a stand to which is fitted a cross-bar upon which the lamp is fixed. This cross-bar is so made that it will slide up and down the stand as required. The resistance is shown separately. The two pairs of carbon electrodes are in series, and may be used together or separately with the tungsten arc. The reflector at the back of the electrodes is easily removed for cleaning purposes, or for adjusting the electrodes when necessary. The large reflector is also removable.

The striking of the arc in this lamp, and in fact in all arc lamps, is a very simple arrangement. One of the handles on either side is turned to the right until the electrodes touch, when the handles are reversed until an eighth of an inch separates the electrodes. This distance is kept for one or two minutes until the electrodes have reached a certain temperature, when they may be separated to a  $\frac{1}{4}$  inch and kept so, as it has been found by experience that at this distance the best amount of ultra-violet ray is obtained. To alter the distance between the electrodes, it should not be necessary to move the handles oftener than every eight to ten minutes, and all that is needed is a half-turn to the right to bring the points slightly closer. Nothing can go wrong, which will be found a great convenience for those living at some distance from a repairer. The current consumption of the carbon arcs is 8 amps, and the tungsten arcs 5 amps.

**The Kromayer Water-cooled Lamp** (Fig. 9), designed by Prof. Kromayer, is manufactured in this country by the British Hanovia Company. Different types of this lamp have to be used for direct and alternating current. The lamp for direct current consists of an inverted U-shaped arc tube of fused quartz; it also has two horizontal polar vessels attached to the end of each tube. The arc tube is surrounded by a quartz jacket, and this again is encased in a watertight metal case, which is fitted in front with a quartz window. At the

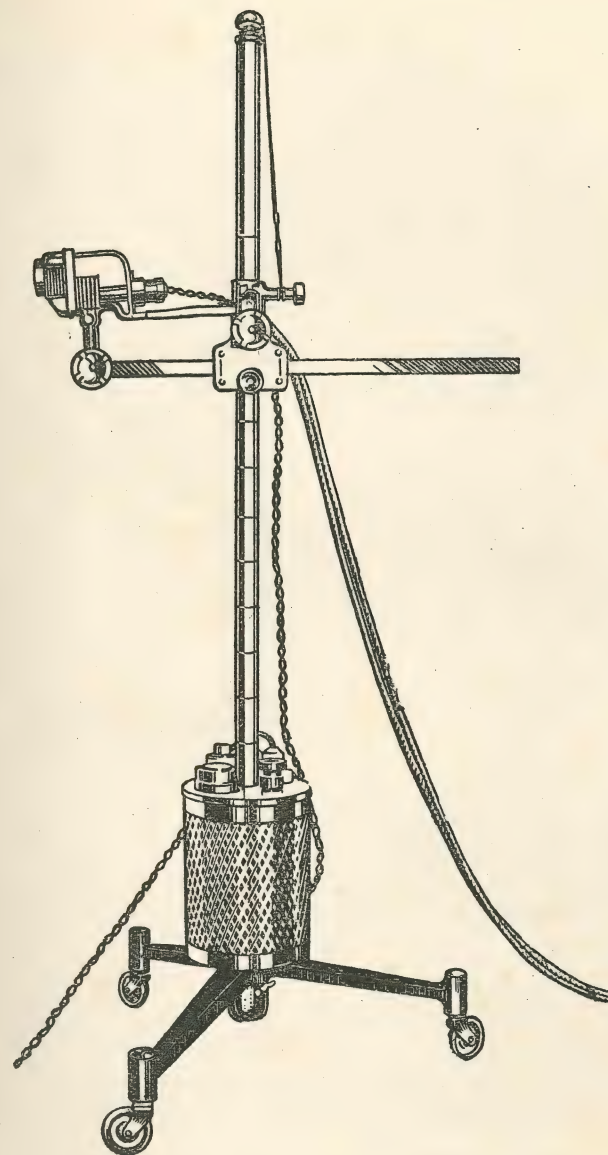
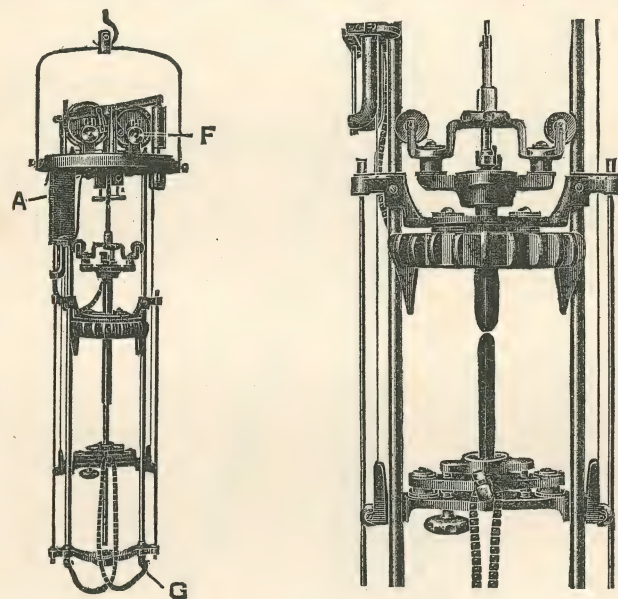


FIG. 9.—The Kromayer Water-cooled Lamp.



back of the case, inlet and outlet openings are situated for the water-cooling arrangement. The quartz window itself may be used for giving the ultra-violet ray or for special applicators. The lighting is the same as for most of the mercury vapour lamps, *i.e.* by tilting it gently forward instead of to the right, and taking it back to the vertical; this brings the mercury in the arc together, and causes the arc to be



Showing lamp without cover.

Close-up view of mechanism.

A, Magnetic coils; F, Counter-balance; G, Insulated leads.

FIG. 10.—“Sunray” White Flame, 30 amp. Automatic feed, Open flaming Carbon Arc Lamp. (Cox-Cavendish Electrical Co. (1924), Ltd.)

struck. When first lighted, the lamp consumes greatly in excess of the normal current. The water circulating must be free from impurities.

This lamp is said to provide the shortest wave-length, and is for local irradiations and skin diseases only.

“**Sunray**” Lamp (Fig. 10).—This type of lamp employs specially impregnated cored carbons and is of the open white

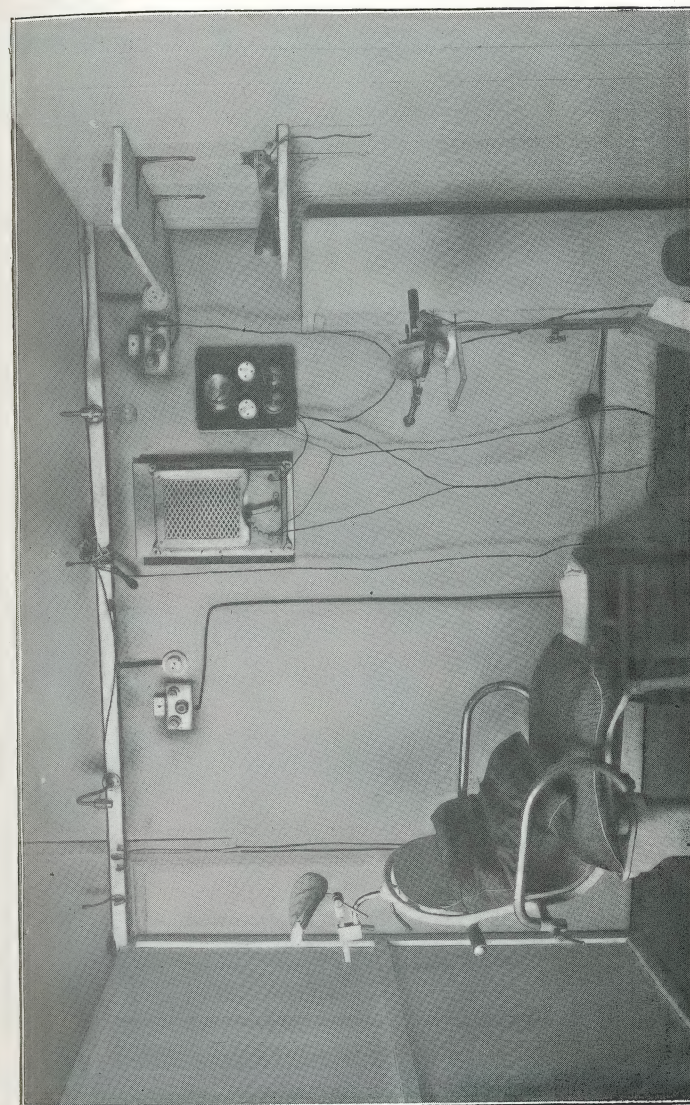


FIG. 11.—Author's Raying Room, showing large and small lamps for local work, with shield for inhalation.  
[To face p. 26.]



flame type, being particularly suitable for treatment of a large number of patients, either children or adults, at the same time.

The action of the lamp is entirely automatic, and the maximum separation of the carbons is approximately  $4\frac{1}{2}$  inches. The arc automatically adjusts itself to the required distance by the operation of special magnet coils. The spectrum of this lamp very closely approximates to that of natural sunlight. The operating current may be anything from 15 to 40 amps., a suitable transformer or resistance being provided. The lamp functions equally satisfactorily on either direct or alternating current. The electrodes consist of one thick impregnated carbon (positive) and a thinner carbon as the negative.

The radiation is emitted from the crater formed in the positive electrode.

The lamp is suspended by means of a steel cord and pulleys from the ceiling, and is quickly and easily adjusted as to height by a self-sustaining hand winch.

**Local Raying Lamp** (Fig. 11). (For local work with tungsten or steel electrodes.)—This particular kind of lamp is well known to the writer, as all his local work is done with it. It will be seen that it is a much heavier make than the smaller lamp mentioned. It weighs about three pounds, and consists of a stand, which may or may not have an angular movable head, and a resistance fixed or not to the stand as required. If working with an amperage meter, it is best not to have the resistance on a stand but on a wall.

The reflector is so made that it can be advanced or retracted from the electrodes, thus enabling the light to be focussed to a 3-inch or 1-inch diameter. Underneath is an aluminium tray to catch any pieces or débris falling from the burning electrode. The electrode is held in position by a steel pin to hold the tungsten, and is so arranged that when the arc is struck by turning one or both handles to the right, the correct distance is attained. Studs are attached to the



resistance, so that 2 to 10 amperes may be used, if found necessary.

Very great heat can be produced with this lamp, bringing

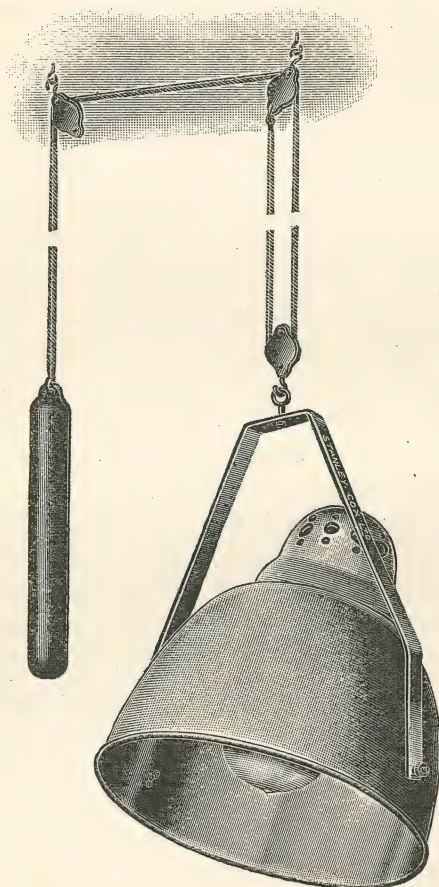


FIG. 12.—Round Radiant Lamp.

out an intense erythema in a few minutes. For neuritis, sciatica, or rheumatism, it is excellent.

**Radiant Heat Apparatus (Fig. 12).**—This lamp can be made in two shapes, round or oblong; a convenient size for the latter is 2 feet by 18 inches. It may be fixed on a stand,

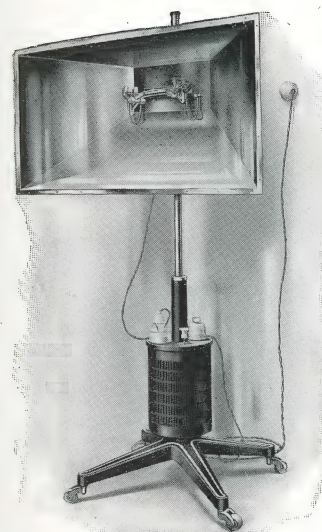


FIG. 13.—Jesionck Lamp

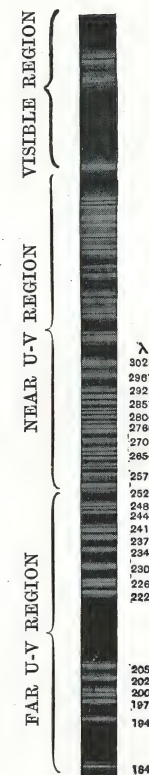


FIG. 14.—Quartz Mercury Spectrum.

[To face p. 28.]



or to the ceiling with a weight or pulley, so as to be suspended over the patient and approached to whatever distance is required. A 1,500 or 2,000 candle-power bulb is fixed inside. For general radiation, or for heating the patient whilst under the tungsten arc or mercury vapour lamp, it is very convenient.

**Jesionck Lamp** (Fig. 13). (Type, mercury vapour.)—This model is designed for the collective irradiation of patients, as in clinics, welfare centres, etc., several of them being used at once round the room. This lamp may be used on direct or alternating current, on stand or suspension.

**Quartz Mercury Vapour Lamps.**—Much has been written on the subject of quartz mercury vapour lamps, so it will not be necessary to deal very extensively with this type here. As is well known, the output is extremely steady after the lamp has reached its maximum peak, which is generally three to four minutes after the arc has been struck. The photographic spectrum shows that it reaches down to the neighbourhood of 2,100 Å.U., but is marked by very distinct wave-length bands continuing throughout the spectrum. These distinct bands may or may not be an advantage, but with that we are not greatly concerned in this book. However, one fact can be definitely stated; that once the lamp is burning at its maximum efficiency, the output as registered by the spectroscope is both constant and steady, which, after all, is of primary importance.

**Mercury Vapour Lamps.**—There are several of these on the market, all good in their way, with various claims put forward on their behalf by the makers. These lamps start in the same way, with a gentle tilt, so as to strike the arc. The "Montana" however, is an exception, as the burner does not require tilting, which is a point in its favour. With all the other types, turn on the switch, and give the lamp a gentle tilt so that the mercury runs across the burner from anode to cathode, or the reverse; this is called "striking the arc." Allow the burner to return to its



original position, leave it for three or four minutes to warm up, and it is then ready for use. The only drawback to this type is that, after the lamps have been used for a period of about 300 hours, the envelope or burner becomes discoloured. In other words, the fused quartz of which the burner is made decomposes, and does not pass the shorter and very necessary

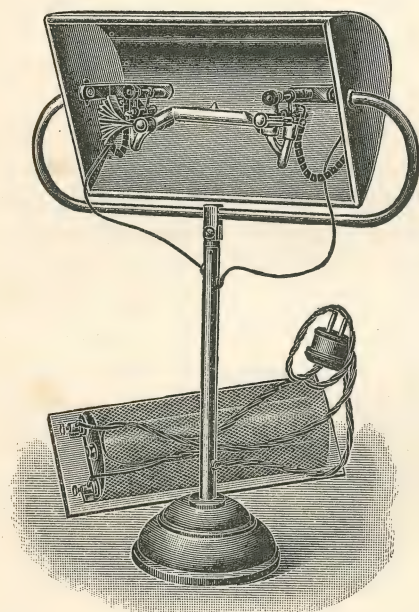


FIG. 15.—"Alps" Model Portable Quartz Mercury Vapour Lamp

wave-lengths. The result is a corresponding drop in the efficiency of the lamp, which necessitates either the replacement of the burner or its return to the makers for cleaning; both equally costly, because if the latter is done, one is faced with the problem of being deprived of the lamp for treatment, or buying a spare burner.

"Alps" Model Portable Quartz Mercury Vapour Lamp (Fig. 15).—The above lamp is designed for portability, and particularly for bedside treatment. A concave duralumin reflector with a rectangular opening is provided, and a standard quartz mercury vapour burner is fitted. The arc is struck by a simple tilting movement of the reflector; the burner itself not being separately tilted is saved a jar. A suitable resistance is supplied for direct current, or a transformer for alternating current. A portable case, made to fit the lamp, can be supplied.

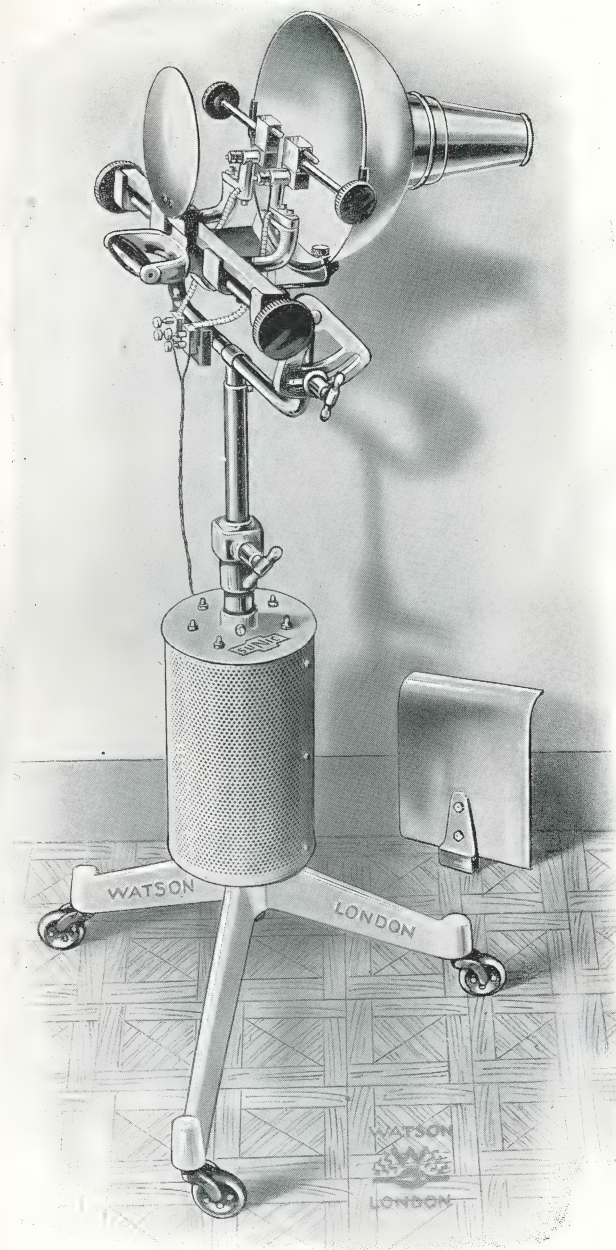


FIG. 16.—The Sunic Tungsten Arc Lamp.

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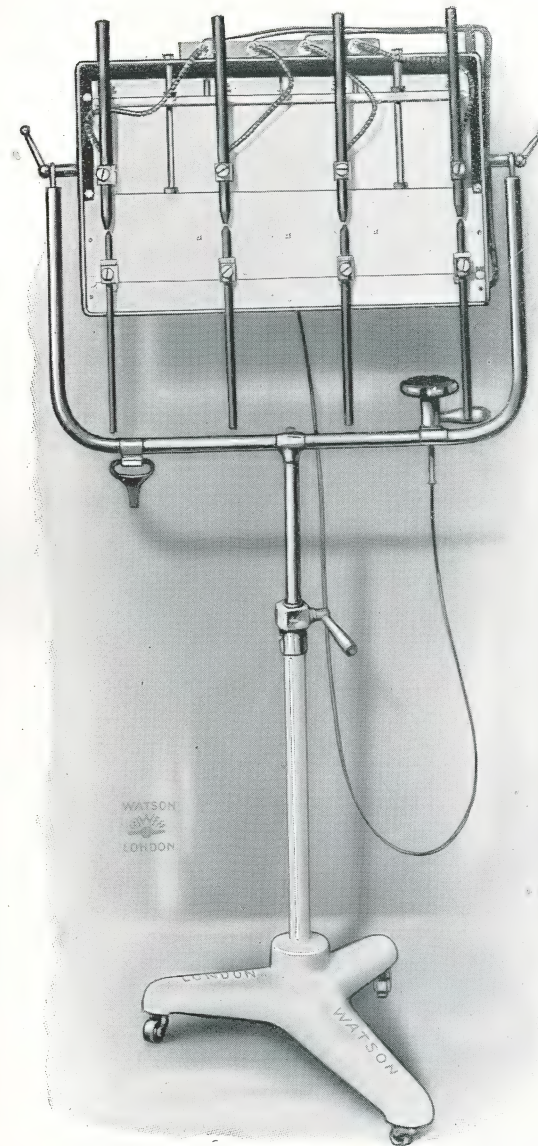


FIG. 17.—Multiple-Carbon Arc Lamp.

[To face p. 30.]



**Sunic Tungsten Arc Lamp** (Fig. 16).—This type of lamp may be used on direct or alternating current ; if with the latter, a motor generator must be installed. Carbon, tungsten, or steel electrodes may be used, and it is claimed that it is suitable for all body baths and local applications, with different localising tubes. The arc is struck by twisting small handles to the right and bringing the electrodes together, immediately separating them to  $\frac{1}{8}$  inch, and when the electrodes are warmed up, to  $\frac{1}{4}$  inch. The resistance is round a stand, which can be moved to any part of the room. This is a very convenient lamp for local work.

**Multiple Carbon Arc Lamps** (Fig. 17).—This lamp consists of four carbon arcs run in series ; it gives an intense radiation for general treatment. It is so arranged, on an adjustable stand with rubber-tyred castors, that it may be moved to any part of the room. The positive terminals of carbon should be on top. The amperage is from 15 to 30. This type of lamp may be used on direct current or alternating current having a voltage of 200 ; on a lower voltage the number of arcs must be reduced.

In the new type of lamp the Bowden wire control for fitting the carbons has been replaced by a direct rack-and-pinion attachment, the milled handle of which is placed immediately behind the reflector on the right, and a splutter tray is also fixed on the horizontal limb. A very useful lamp for hospital or clinic work where a number of cases can be treated at once.

**The Apex Lamp.**—The writer has examined and tested two very interesting portable lamps that are supplied by the Apex Sun Ray, Ltd. These merit attention for several reasons, the chief of which is their extreme simplicity, portability, and small size.

*Model No. 1* (Fig. 18) is a very compact little unit. The resistance is wound in the stand, and it can be run off different lighting circuits of varying voltages from 100 to 260.



The method of inserting the carbon electrodes is a little out of the usual, that is to say, that instead of the electrodes being inserted so that the arc is struck on the horizontal plane, they are inserted in parallel series in the direction of the patient. This, in practice, proves an advantage, as it enables the arc to be opened to a distance of 1 inch; at the same time the electrodes burn evenly and steadily until they are exhausted. Another useful feature is the small thumbscrew adjustment of the arc; this has a general action, and enables fine adjustments to be made.

*Model No. 2.*—From the medical man's point of view, this is perhaps the most interesting. It is arranged for use in conjunction with Model No. 1, as at present there is no independent resistance supplied. The lamp itself is fitted to an adjustable stand which can be locked into position with a thumbscrew. In addition it is pivoted on a ball joint, also locked by a thumbscrew, which enables the lamp to be moved in any direction, and to any angle. It can be taken off the stand, and used as a hand lamp to irradiate various parts of the body. Another well-planned feature is the provision of a cone-shaped hood fitted on an adjustable rack, which holds a frame for inserting filters. Owing to its extreme lightness and portability, local areas of small diameter can be treated. For so small a lamp, the output of ultra-violet radiation is exceptionally good; on the spectroscope it was clearly defined to 2,200 Å.U., being, of course, extremely rich in the longer wave-lengths around 3,500 Å.U., as carbon electrodes are used. When necessary, tungsten electrodes could be used, if direct current is available.

There is no reason why Model No. 1 should not be used in the home, if under medical supervision. An amperage of 2 is taken to maintain the arc at a steady even burning rate, which enables it to be worked off any lighting circuit.

**The Heliol Lamp** (Fig. 19).—This lamp is an enclosed



FIG. 18.—The Apex Lamp. Model No. 1.

[To face p. 32.]



carbon arc lamp, which operates in an atmosphere of carbon monoxide and cyanogen. Owing to the absence of an excess of oxygen in the enclosed chamber in which the arc operates, carbon monoxide, which is a good conductor of electricity, is formed instead of carbon dioxide, which is a bad conductor. The resultant high temperature causes the carbon of the electrodes to combine with the liberated nitrogen and form cyanogen. In this atmosphere it is claimed that an arc of 2 inches in length between the poles can be maintained, working on an electricity supply of 220 volts. The chamber in which the arc operates is sealed, so that there is no escape of gas. The arc is enclosed in a glass or quartz globe. It is claimed for this lamp, that with a quartz globe a large volume of ultra-violet ray is given off down to 2,500 Å.U., but the author has had no opportunity of testing this lamp.

**"Uvral" Automatically-controlled Ultra-Violet Ray Apparatus.**—This apparatus, with the expometer, is exceedingly ingenious. The Uvral part or expometer may be used together or separately. The former is a portable ultra-violet ray outfit specially designed for the use of practitioners or masseurs who give treatment to patients in their own homes. It has an adjustable resistance, which enables it to be used on any voltage from 100 to 240. The source of ultra-violet ray is an automatic arc, which when operating on direct current, has pure tungsten as the positive pole, and tungsten-cored carbon or plain carbon as the negative pole. When operating on alternating-current circuits, both poles are tungsten-cored carbons. As regards length of exposure, the apparatus is automatically controlled by means of the "expometer," which, as its name implies, is an exposure meter, and is built into the cabinet containing the apparatus. The apparatus will not function until the expometer has been set for some predetermined exposure of one to fifteen minutes, when, upon expiration of the time, the current is automatically cut off. The whole apparatus



## CHAPTER V

### SPECTRUM

Spectroscope—Spectrum—Length of spectrum—Solar spectrum—Herschel's experiment—Prof. Langley's Bolometer—Photographing the spectrum—Bridging the gap between ultra-violet and X-ray—Splitting up the rays.

**Spectroscope.**—Of all the useful instruments invented as far as ultra-violet radiation is concerned, this probably comes first. Without it we never could have progressed to the extent we have in the last twenty or thirty years, nor could ultra-violet radiation have gone ahead as it has up to the present. It therefore becomes necessary for those using this ray in a scientific manner, to have a good knowledge of the spectrum and spectroscope.

The latter is an instrument which, of course, has its place in every laboratory. The following is its principle. The source of light is focussed upon a narrow slit by the aid of a cylindrical quartz lens, which is located at the end of a tube called the culimator. This beam of light is again focussed with quartz lenses upon one of the faces of a quartz prism which in turn disperses the light at an angle, and is there registered on a fluorescent screen. The visible spectrum will be seen split up into its primary colours on the right. To the left, continuing from the visible violet, will be found the ultra-violet portion of the source of light dispersed down the screen. This can be measured with the wave-length scale attached to the screen. The ultra-violet portion of the spectrum will appear a brilliant apple green, or a dull olive



according to the intensity—very much the same as described in the Actinoscope.

This is unquestionably the best method of measuring ultra-violet wave-lengths. If there is any ultra-violet present, it can be seen immediately, and to what wave-length it reaches down the spectrum. It is infallible for checking the output of a lamp, and when the visible type is used, the presence of ultra-violet ray can be detected, and the intensity also gauged to some extent, by reading off the wave-length scale.

**The Spectrum.**—The spectrum is the screen on which the colours are shown after passing through these prisms, and is divided into the visible and invisible. The latter can be observed by fluorescent screens or by photography, and is called the electro-magnetic spectrum, lying beyond the violet rays, and bordering at one end on the Hertzian waves. The wave-length of the latter may be more than twenty kilometres, and passing through the visible region of the spectrum, terminates in the radium rays, the wave-length of which varies from 1 Å.U. to .015 Å.U. (The Ångstrom unit is abbreviated by Å.U. and is equal to one ten-millionth part of a millimetre.) Luckiesh states that "if a normal spectrum of this entire range of wave-lengths of radiant energy could be produced, and the portion of it due to visible radiation, that is light, were one foot long, the entire spectrum would be several million miles in length."

**Solar Spectrum.**—The visible portion of the solar spectrum contains the seven primary colours merging into each other, each with its approximate wave-length. We have all seen a rainbow at some time, in which there is the perfect solar spectrum with these seven primary colours, starting from the long, and running down to the short wave-lengths, as red, orange, yellow, green, blue, indigo, and violet. If these were painted on suitable bands on a cardboard wheel and whirled round so that they were continuous to the eye,

the wheel would no longer be gay with colours, but show out white and clear. White is no colour, but a combination of all colours at once.

Each colour has its own wave-length and frequency.

Colour.	Average wave-length.	Frequency.
	(Å.U.)	(million millions per sec.)
Red .. ..	6,000 to 6,500	375
Orange .. ..	6,100	571
Yellow .. ..	5,500	541
Green.. ..	5,200	595
Blue .. ..	4,750	622
Indigo .. ..	4,500	668
Violet .. ..	4,200	750

By means of rocksalt and sylvine prisms, the spectrum has been extended up to  $9\frac{1}{2}$  octaves to the Hertzian waves. In 1800, Herschel, in one of his experiments, broke up a beam of light into its primary parts by passing it through a prism, and he also showed the presence of infra-red rays with a rise of temperature of several degrees when the blackened bulb of a thermometer was placed beyond the red, whereas in the other parts of the spectrum there was no difference. Professor Langley, using an extremely delicate instrument called a bolometer, has been able to show a rise in temperature amounting to only one hundred millionth part of a degree centigrade.

Rays of greater frequency than in the visible spectrum are formed by ultra-violet radiation. The region between 4,000 Å.U. and 1,850 Å.U. can be recorded by means of a quartz prism and lenses. Schumann, using a vacuum spectroscopy and fluorite in the place of quartz, recorded the area between 1,850 Å.U. and 1,230 Å.U.

Below 1,700 Å.U. the atmosphere is absorbent, though Lyman takes the view that this shows itself about 2,000 Å.U.



The gap between these and the X-ray wave-lengths has been accounted for by Lyman, Millikan, and Holweck. Lyman reached 510 Å.U. by passing strong electric charges through helium vacuum; Millikan reached 202 Å.U., and Holweck reached 500 Å.U. by means of slow cathode rays. However, for medical purposes, the wave-lengths between 4,000 Å.U. and 1,800 or 1,850 Å.U. are sufficient.

Browning and Russ divide these rays into two definite areas; those from 3,800 Å.U. to 2,960 Å.U. having great power of penetrating the human skin, with little or no bactericidal effect, and those from 3,000 Å.U. to 2,000 Å.U. with very little penetration, but strong bactericidal effect.

Before leaving the subject, it is as well to know the wave-length of the complete spectrum, for without a good knowledge of this subject we cannot expect to treat cases successfully. Undoubtedly those practising in this ray will find that the wave-length beneficial for one class of disease will take much longer to bring about the same results (we will not go as far as to say that they will have no effect) in others.

#### COMPLETE WAVE-LENGTH OF SPECTRUM

Hertzian wave-lengths or oscillations, 3 mm. to several kilometres.

Infra-red	..	..	..	..	6,500 Å.U. to 3 mm.
Visible spectrum	..	..	..	..	4,000 Å.U. to 6,000 Å.U.
Ultra-violet	..	..	..	..	1,000 Å.U. to 4,000 Å.U.
Those in use for medical purpose	..	..	..	..	1,850 Å.U. to 4,000 Å.U.
X-rays	..	..	..	..	12 Å.U. to 15 Å.U.
Those in use for medical purpose	..	..	..	..	1 Å.U. to 0.15 Å.U.
Gamma rays (radium)	..	..	..	..	.1 Å.U. to .015 Å.U.

## CHAPTER VI

### DETECTION AND MEASUREMENT OF ULTRA-VIOLET WAVE-LENGTH

Lamp tests: Chemically, with the Actinoscope, with the Spectroscope.

**Lamp Tests.**—The reader will naturally want to find out some accurate method of testing his lamp. This must not be confused with "dosage." However, it follows that one cannot take place without an accurate knowledge of the other. The result of the lamp test will considerably modify the dosage to patients; therefore, it will be seen that it is most necessary to obtain some method that will give him a good working knowledge of the output of his lamp. At the same time, this test must not be complicated, nor take up too much of the busy practitioner's time. There are three methods of making this test: (1) chemically, (2) with the actinoscope, (3) with the spectroscope. Let us look at all three and see which is likely to be the best.

**Chemical Test.**—Some writers pin their faith upon this test; however, it must be looked at from the angle of a chemical test, and therefore not infallible at present. It matters not whether methylene blue, carbon tetrachloride, iodine, or any other chemical property is used, the result must be more or less the same. That is, that all three tests are based upon the chemical reaction that light has upon the capsule, dye, or fluorescent material being experimented with. In other words, instead of exposing these tests to the naked light of an arc, a filter should be interposed so that it absorbs or cuts out the visible radiation as far as is possible.



It must be remembered that the object is to measure or obtain some idea of the quantity and quality of ultra-violet rays, which, of course, are invisible and must therefore be separated, otherwise the test becomes partly the test of ultra-violet rays and still more so of visible rays.

**The Actinoscope.**—Here we have an exceedingly useful little instrument, which does practically everything required. It always gives uniform results, as it has no chemical components, nor is it affected in any appreciable degree by visible light, because until it is focussed on the lamp nothing can be seen.

The actinoscope consists of a telescopic tube 6 inches in length, and about 1 inch in diameter; at one end is placed a special glass filter not less than  $\frac{1}{4}$  inch in thickness, and opaque to all visible light, with the exception of the very low violet radiations at the commencement of the visible spectrum. At the other end of the tube is a uranium glass screen, which absorbs all the ultra-violet radiations, and causes the screen to fluoresce according to the intensity or quantity of ultra-violet rays passed by the filter. So sensitive is this, that when a piece of welder's blue glass or other tinted lens is interposed between the filter and the lamp, a very slight shadow is cast on the screen, which denotes that the wave-lengths absorbed by this glass have been cut off, and only the higher wave-lengths which are transmitted through the glass, are registered on the screen. A shield is attached at the screen end of the telescope to protect the eyes when examining the lamp.

Embodied in the shield on either side are two standard colour gauges, the one on the left being a brilliant apple-green, and the other a dark olive-green. When the actinoscope is held in line with the arc of the lamp, one can readily detect whether the lamp is rich in ultra-violet output or not, by comparing the tint shown on the fluorescent screen with the standard colour gauges on the shield, the one on the left

(apple-green) being the desired tint to aim at. The colour gauges are carefully matched with the colours as shown on the spectroscope, when the lamp is giving a rich or poor emission of ultra-violet rays, as the case may be. If further proof is needed that only ultra-violet rays are being transmitted, and are acting on the uranium screen, take any glass or other filter, which cuts out a considerable portion of the visible rays, but transmits ultra-violet rays, and place it in

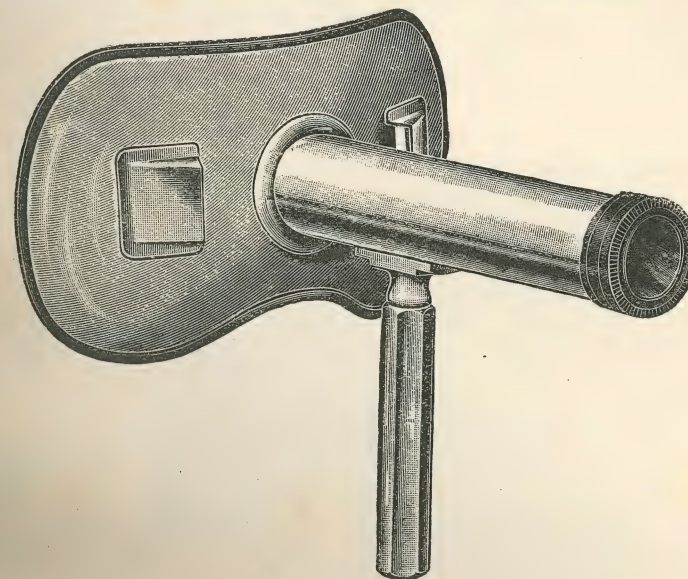


FIG. 22.—The Actinoscope.

front of the actinoscope, when it will be seen that it has no effect on the intensity or brightness of the fluorescent screen. After a little practice with this instrument, it will be found that from a point of convenience it is only a matter of seconds to detect the quality and quantity of ultra-violet ray; also, its uses for experimental purposes are many.

The actinoscope can be obtained from any well-known electro-medical house; it is made by Messrs. J. & R. Fleming, Ltd.



**Spectroscope.**—This instrument has been described very fully on p. 35. Unfortunately, a good spectroscope is perhaps beyond the means of the average practitioner, but if accuracy of dosage is desired, it is necessary to make use of this instrument. It has been shown that the chemical test cannot be relied on up to the present, and that the actinoscope, although extremely useful, does not give the wave-lengths in the same way as the spectroscope.

Fig. 23 is an illustration of an Adam Hilger quartz spectro-

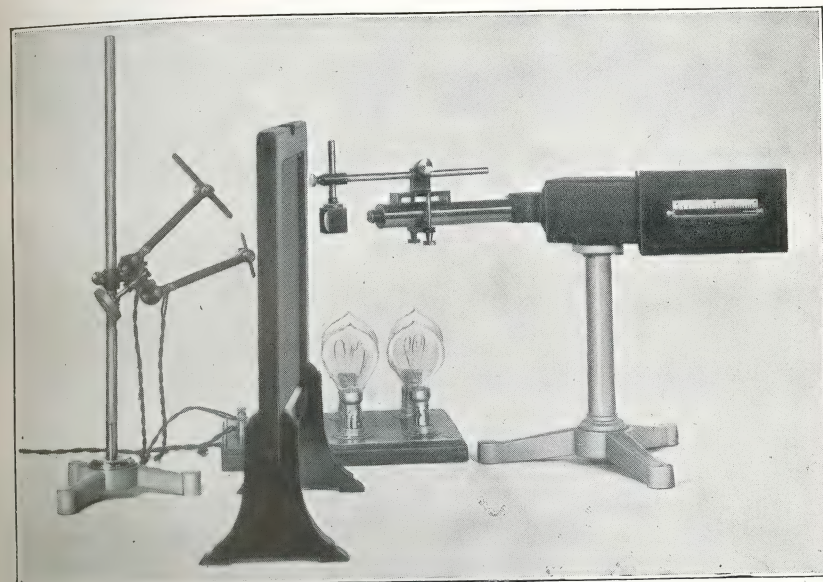


FIG. 23:—Adam Hilger Quartz Spectroscope, with Uranium Screen.

*To face p. 42.*



## CHAPTER VII

### ELEMENTS AND ELECTRODES

Variation of intensity in different electrodes—Amperage—Adam Hilger spectroscope—Tests—How electrodes are obtained—Tests with certain electrodes—Photographic tests—Visual tests—Detailed visual analysis—Metallium electrode—Photograph from National Physical Laboratory.

A DETAILED and exhaustive study of the actinoscope and spectroscope, in which spectrophotograms were also taken, shows that in both quality and output of ultra-violet there are a great many variations, some of which merit the closest attention. It must be borne in mind that although there may be a great amount of visible glare or intense light, this does not necessarily indicate that the output of ultra-violet ray is correspondingly large.

**Variation of Intensity in Different Electrodes.**—An inspection of the various lamps on the market, shows that the light given off by the mercury vapour is very intense, and compared with a lamp in which a pair of plain or cored carbons are used the intensity of visible light from a metal electrode or element, is not nearly so great; yet it has been definitely proved that the metal element is far superior in its output of ultra-violet ray to any plain or combined cored and plain carbons.

To some people this may be a somewhat startling statement to make, but it is hoped to prove it definitely with accompanying illustrations.

**Amperage.**—The amount of current used, from a point



of efficiency and economy, proves that it is not the highest amperage which gives the greatest efficiency.

For instance, in one of the tests conducted, when a pure metal element combined with plain carbon was used, the output at approximately  $3\frac{1}{2}$  amps. was exceedingly good. On increasing the amperage to 6, 8, and 9, there was, unexpectedly, a sharp decrease in the quantity and quality of the ultra-violet output, as registred by the visible spectro-scope. This was so unexpected, that the test was applied many times, at intervals of a few days, to eliminate the possibility of error in these observations. This explains why the amperage is given in each test of the various metals, and this point should be noted carefully in the tables and illustrations given.

Before going any further, it should be added that the instruments used for these tests were the Adam Hilger quartz visual spectroscope, photographic spectroscope, and actinoscope.

**Tests with Certain Electrodes.**—These tests are divided into two classes: (1) Visual tests, (2) Photographic tests. In some of the elements under visual test, it was found, on taking an average, that the output, as shown on the fluorescent screen, was only moderate, combined with occasional momentary flashes of brilliant ultra-violet. This, of course, no matter how short it might be, was recorded on the photographic plate.

A table will be found below showing various electrodes with results obtained visually and photographically, with the length of time for each test. It is as well to state here that no bias was shown to any particular electrode; they were all obtained on the open market, from various sources, and the suppliers were not aware that these exacting tests were being made. They represent nearly all the electrodes that are sold, and used in the many lamps by those practising ultra-violet radiation to-day. These tests were all con-

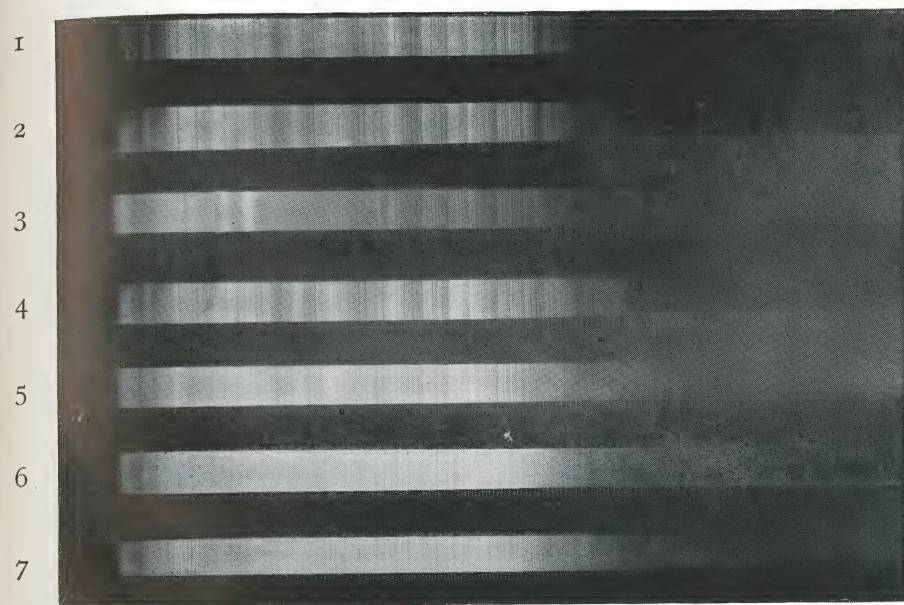


FIG. 24.—1. Tungsten Square (2); 2. Tungsten Round (2); 3. Steel (2); 4. Cored Carbons (2); 5. Plain Carbon (2); 6. Metallium and Plain Carbon; 7. Metallium (2)

*It may be stated that this photo has not been touched up.*

[To face p. 44.]



ducted with direct current, and so far as is known none of these elements will work off alternating current, with the exception of cored and plain carbons when used together.

**Tests.**—The visual test consisted of carefully linking up the source of light with the visual quartz spectroscope and the output of ultra-violet as recorded on the fluorescent screen of the spectroscope. This was watched for a period ranging from fifteen to twenty minutes. For the photographic test, a suitable spectroscope of the same make was used, but, of course, adapted for taking plate photos.

The writer ventures to suggest that the visual tests are far superior to the photographic ones, when one considers the fact that the visual tests lasted for periods ranging from fifteen to twenty minutes under close observation, whereas the photographic tests were only for a period of half a minute. It is quite obvious that the output of ultra-violet for treatment purposes, must be maintained for a much longer period.

#### **Analysis.**—

##### PHOTOGRAPHIC. (See Fig. 24.)

*Nos. 1 and 2.*—Tungsten electrodes seem much superior to any of the others.

*No. 3.*—Plain steel is the next best.

*No. 4.*—Cored carbons do not show up quite so well.

*No. 5.*—Plain carbons show up badly.

*No. 6.*—Metallium electrode and plain carbon show up very well.

*No. 7.*—Metallium electrode also very well.

##### VISUAL

Under a visual test of not less than fifteen to twenty minutes each, one would expect the results to be very much the same as the photographic, but this was by no means the case.



No. 1.—The output as recorded by the spectroscope was very intermittent, that is to say, the output in comparison with the photographic test, was marked by periods sometimes extending for as long as four to five minutes, when there was very little ultra-violet shown.

No. 2.—Almost identical with No. 1.

No. 3.—This was also marked by periods of violent fluctuation in the output, and a great deal of spluttering was observed, caused primarily by the fact that there was too much manganese in the composition of the steel.

No. 4.—This was also marked by long periods of poor output, and a great deal of spluttering, caused, in the writer's opinion, by the metal element in the core burning far more quickly than the surrounding casing of carbon, thereby producing very erratic results, as nearly all these cored carbons do.

No. 5.—As shown in the photograph of the spectrum, the output was by no means good, and was accompanied by an excess of light in the visible region; but on the other hand it was steady and continuous through the period of observation.

No. 6.—Metallium electrode and carbon was shown to great advantage, and the output as recorded by the photographic plate, had no variation whatsoever, and no break in the arc for twenty minutes continuously. One cannot speak too highly of this combination.

No. 7.—Two metallium electrodes; the results were precisely the same as with No. 6. Either of these is equally good element to use, as from the moment the arc is struck, an extremely rich and continuous output is given, which after all is the most desired object at which to aim.

## DETAILED VISUAL ANALYSIS

<i>Electrode.</i>	<i>Period of observation.</i>	<i>Amp.</i>	<i>Remarks.</i>
Squared tungsten, obtainable everywhere	15 to 20 mins.	3 to 4	Periods of intense output extending down to 2,000 Å.U., followed by long periods of indifferent output extending down to 2,700 Å.U. Arc broken many times. On the whole unreliable and disappointing. A good deal of dropping metal and splintering.
Small round tungsten	15 to 20 mins.	3 to 3½	Good output on the whole, extending down to 2,000 Å.U. At times extremely rich. Spluttering and falling pieces not so noticeable. On the whole more reliable than the square. But output not steady and continuous.
Two pieces of steel. Supplied by a well-known house	15 to 20 mins.	3 to 3½	Good output extending to 2,200 Å.U. with distinct bands. Subject to a great deal of spluttering and falling pieces. Breaking of arc and sparking effect due to high content of manganese, and low content of carbon. Periods when a very poor output was shown.
Cored carbons. Two pieces	15 to 20 mins.	3 to 4	Comparatively poor output, with occasional periods of richness extending down to 2,300 Å.U. Great spluttering and breaking of arc. Could be best compared to children's sparklets. From a medical point of view, thoroughly unreliable.
Plain carbons. Two pieces.	15 to 20 mins.	3 to 4	Fairly rich and steady in output, but only extending down to 2,300 Å.U. Richest round about 2,900 Å.U. upwards. Useful when quantities of long rays are required, but very deficient in the shorter and medium rays.



<i>Electrode.</i>	<i>Period of observation.</i>	<i>Amp.</i>	<i>Remarks.</i>
Metallium electrode and plain carbon	15 to 20 mins.	3 to 4	Immediate and continuous image down to 2,200 Å.U. Absence of spluttering and falling pieces of metal. Output, whilst rich and steady, not quite so good as that given by the metallium alone.
Metallium electrode. Two pieces	15 to 20 mins.	3 to 4	Immediate and continuous image down to 2,200 Å.U. Absence of spluttering or falling pieces of metal. Distinct bands throughout the spectrum, and an extremely rich and steady output. Unquestionably the most efficient of any tried.

The foregoing bring us to one definite conclusion; that the problem of the best electrode for medical purposes has not been solved yet.

This leads us to the fact that the various constituents which make up an electrode, whether they be metallium, carbon, or carbon core, should have an analysis accompanying each piece sold, so that it can be kept to a definite standard and thus eliminate to a great extent the marked difference in these electrodes, which the tests showed with such excellent results for the metallium electrode.

**Metallium.**—The writer was very dissatisfied with the results from the electrodes supplied by the trade, and owing to the great assistance given to him by Mr. H. G. Somerfield, M.Inst.Brit.F., M.Inst.Met. (secretary of the London branch of the British Institute of Foundrymen), he was able to have a metallic electrode manufactured that would act in a more reliable manner than others on the market.

It has thus been possible for the first time to lay down a definite analysis for a metallic electrode, making for

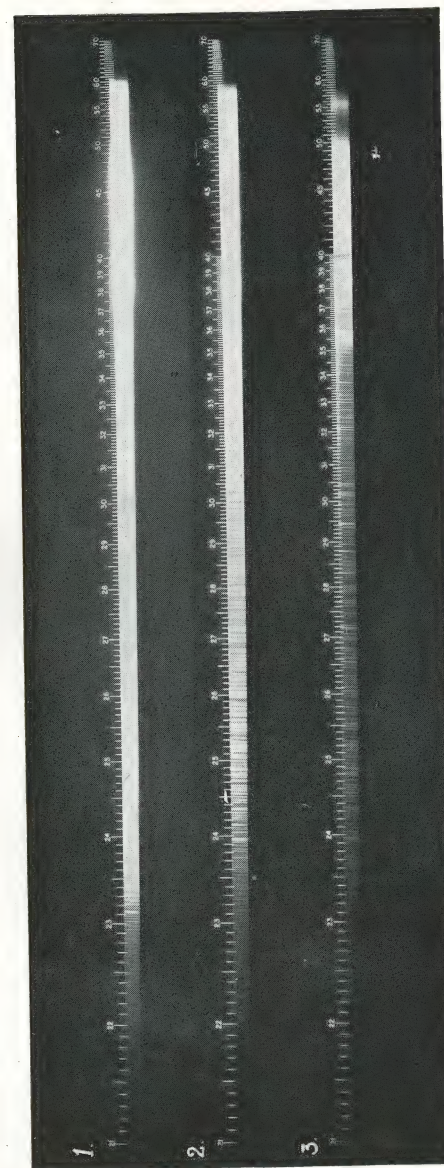


FIG. 25.—Three Photographs of different exposures from the National Physical Laboratory. [To face p. 48.]



uniformity in quality, which will be of real assistance to many in their medical work.

This electrode, known as "metallium electrode," is now being placed on the market by Messrs. Stanley Cox, Ltd., of 30, Percy Street, W.I.

Although the photographic tests are useful for showing the extent of output of any lamp, it does not necessarily follow that this output is maintained for a period of, say, fifteen minutes with practically no fluctuations.

The continuous output of ultra-violet ray is the object to be aimed at, for when one takes into consideration the fact that some exposures on patients are only for a period of two to three minutes at first, it is quite possible that the patient would be exposed to very little ultra-violet ray.

If further proof were needed of the fact that spectrophotograms are not always to be relied on, the accompanying illustration is well worth examining.

Fig. 25 is a reproduction of a plate taken at the National Physical Laboratory, and it represents the output given off by an ultra-violet ray lamp, using alternating current with a consumption of 3.5 to 4 amps. The lamp was not touched in any way during the test. Both electrodes were cored carbons.

No. 1 was given an exposure of 100 seconds.

No. 2     "     "     "     10     "

No. 3     "     "     "     1 second.

It seems difficult to believe that this was the same lamp, but such was the case. It therefore brings us back to the writer's contention, that the visible test for medical purposes is far superior to the photographic.



## CHAPTER VIII

### QUARTZ AND GLASS

Use of pebble for lenses—Where found—Replacement of pebble with glass—Goggles and their uses—Corneal ulcers and infra-red rays—Arkos—Saniweld—Noviweld—Pfund—Well-known glasses and tests—Goggles under photographic tests.

#### QUARTZ

SINCE natural quartz plays such an important part in the use of ultra-violet ray treatment, it is not without interest to note how the raw or rock crystal quartz is found. It can be obtained in several parts of the world, but the chief source of supply is Brazil. It is noted for its good quality from this source.

**Use of Pebble for Lenses.**—Many years ago, it was extensively used for lenses of spectacles, and these lenses were commonly known as pebble lenses. One of its chief advantages then was its great density or hardness, which rendered it much less liable to scratches or blemishes when in use. Owing to difficulties in the grinding and polishing, to the fact as elsewhere stated that it freely transmits ultra-violet rays, and for many other reasons, it was gradually displaced by crown glass. The latter is a manufactured glass, is easily worked, and while transmitting a goodly proportion of ultra-violet rays, does not do so to the extent of quartz or pebble. It may be mentioned that the rock crystal quartz in its natural state was picked up by natives, who became adepts in the selection of the most suitable pieces, and traded it, and so it reached the optical manufacturers, who finally worked it into its many forms.

**Replacement of Pebble with Glass.**—Owing to the fact that the older generation did not teach their children to find this now valuable commodity, and also to the fact that to-day the use of quartz in spectacle lenses has entirely ceased, it has now become scarce and difficult to obtain. Consequently the price of it in its finished form has greatly increased; therefore, as usually happens, a manufactured substitute has been evolved, generally known as fused quartz. As it is manufactured, it can be made into various forms, and has indeed proved a great boon. For instance, the burners of quartz mercury vapour lamps are made of it, and it is also made in sheet, rod, and tubular form, but it lacks the crystal clearness of the natural substance. It is called optical quality, and can be freed from waves and blemishes to a great extent, but does not by any means approach the quality of the natural product, and therefore could not be used in such a delicate instrument as the spectroscope. Even if it could, its cost is prohibitive, as it has to be made to special order. It is sold by the gramme in this form, which will give some idea of its cost.

#### GLASS

Mention has been made of the important part that the spectroscope plays in the estimation and measurement of ultra-violet rays, but it has another and almost equally important use, to which reference will be made further on.

**Goggles and their Uses.**—As is generally known, goggles must be worn both by the operator and the patient during the time that the lamps are in use. The necessity for this cannot be too highly stressed, as all the lamps now in general use are not only capable of producing rich sources of ultra-violet rays, but also infra-red rays or heat rays, both of which, while being so valuable for medical purposes, are extremely dangerous to the eyes. Ultra-violet rays cause conjunctivitis, and infra-red can cause corneal ulcers. The



former, as a rule, starts about six to eight hours after exposure, generally at night, and has to be experienced to know the extreme pain, irritation, and violent headaches it causes. The writer has seen many such cases, and has carefully noted the fact that, once subjected to an attack, the eyes are always sensitive to these rays. In his own case, and in many others known to him, the eyes are affected when reading or doing close work even under ordinary electric light. If one is unfortunate enough to contract this on several occasions, it will be found that reading or writing under artificial light can only be indulged in for short periods.

**Corneal Ulcers and Infra-Red Rays.**—Corneal ulcers caused by infra-red rays have been known to lead to loss of sight, a condition which is very prevalent in the glass-blowing industry, and which led to an investigation by the late Sir William Crookes, O.M., at the instance of the Government. Therefore it is necessary that the glass used in goggles should be proof against ultra-violet rays, and as far as possible against infra-red rays. Such goggles can be obtained from all the well-known electro-medical suppliers, and are sold in many forms and at varying prices. A description of some of the glasses would not be out of place here.

**Well-known Glasses and Tests.**—*Arkos* is one which is popular, owing to the fact that for a tested glass it is sold at very moderate prices, and in a variety of styles. This in appearance has a deep green tint, is quite proof against ultra-violet (every pair being tested at the works), and only transmits from 8 to 10 per cent. of infra-red rays, which is remarkably good.

*Saniweld* is another well-known glass, used in a slightly more expensive type of goggles. It is tested against ultra-violet rays to a very exacting degree, and only transmits 10 to 30 per cent. of infra-red rays. It is a very pleasant glass to use, and has a colour of its own, which perhaps might be called sand-colour.

*Noviweld* is the name of yet another glass, which, perhaps, should really be called a lens, as it is optically worked. It is proof against ultra-violet, and cuts down the transmission of infra-red rays to the very low figure of 1 to 3 per cent. When it is realised that 0.50 per cent. is considered proof against infra-red rays, it can be seen to what a fine degree this product has been brought. In colour it is very similar to *Saniweld*, but it is easily distinguished by the monogram "N. W." etched on the lens.

There is also a lens known as *Pfund*. Perhaps this deserves note more than the others, owing to its striking appearance and the wonderfully soothing effect it has on the eyes. It consists of a *Noviweld* lens, which has a fine layer of pure gold deposited on one side, the action of which is to reflect the heat rays away from the eyes. It is, of course, quite proof against ultra-violet rays. It has many advantages: the action of the gold mirror keeps both the eyes and the lens very cool, and its transmission of heat rays is so slight that it is practically immeasurable. For those engaged on research work, or exposed for long periods to ultra-violet or infra-red rays, it is invaluable. In fact, there is no known lens which can in any way compare with it.

So far, we have principally dealt with protection lenses that are well known, easily obtainable, and very efficient; but whilst on the subject, it will be interesting to deal with some other types of well-known glass, their merits and demerits.

The following is an instance of the care which should (and must) be exercised in the selection of suitable goggles. Tests were made for transmission of ultra-violet rays (which, by the way, can be easily verified by the spectroscope or actinoscope) with three forms of glass, known generally as welder's blue or cobalt blue, London smoke, and fieuzal. All these were of an equal density, and are indexed by glass manufacturers as shade No. 6. This density or tint is quite suitable when using ultra-violet apparatus, as it cuts down



visible light to a very marked degree, and seems quite comfortable to the eyes, but when tested with the spectro-scope, all three forms of glass were found to transmit a very large proportion of ultra-violet rays.

In Figs. 26 and 27 will be found the results of tests carried out in the laboratories of Messrs. Adam Hilger, under independent supervision, and with the most efficient type of spectroscope yet produced. The name of this firm is sufficient guarantee. There will also be found the results of tests of the recommended glasses, which show total elimination of all harmful ultra-violet rays. It may be stated that all the glasses under test were chosen from a manufacturer's stock, and the exposures in every case were identical, viz. half a minute.

All spectro-photograms should be examined with the aid of a reading glass, or powerful magnifying glass.

**Goggles under Photographic Test.**—Seeing that so much has been stated about the absorptive properties of various glasses, tinted and otherwise, which has not always been accurate, to say the least of it, a detailed analysis of the foregoing spectro-photograms will not be out of place.

Fig. 26: No. 1 shows a transmission of an open arc, which consisted of two pieces of metallium steel. The same electrodes were used throughout the test, each exposure being of half a minute's duration.

No. 2 shows the result of No. 6 tint, welder's blue. This was placed in front of the source of light and the slit of the spectro-scope. It will be seen that there is a considerable transmission definitely extending down to 2,950 Å.U.

No. 3.—A piece of No. 6 tint, smoke, was inserted, which showed a definite transmission down to 3,000 Å.U.

Nos. 4, 5, and 6 consist of a piece of Cruxite, Crookes A, and Crookes B2 respectively. The results are extremely interesting as this glass is frequently recommended for use

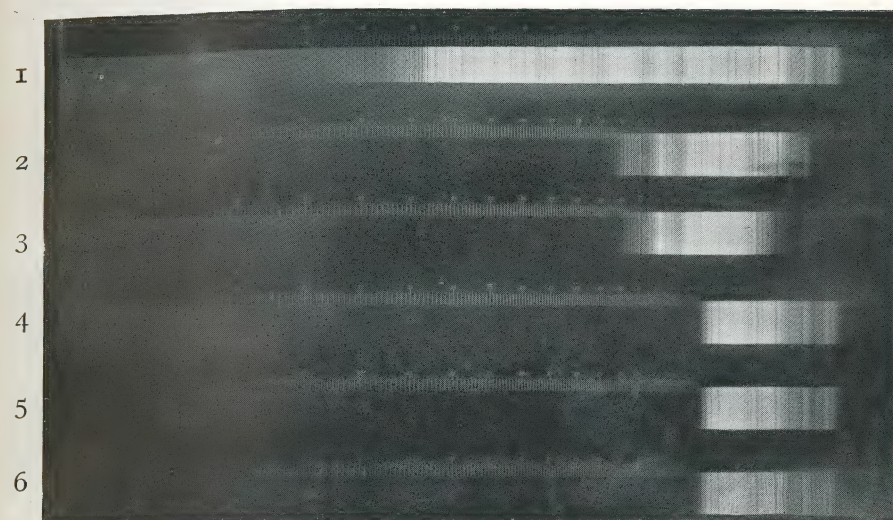


FIG. 26.—Glass Transmission of Ultra-violet.

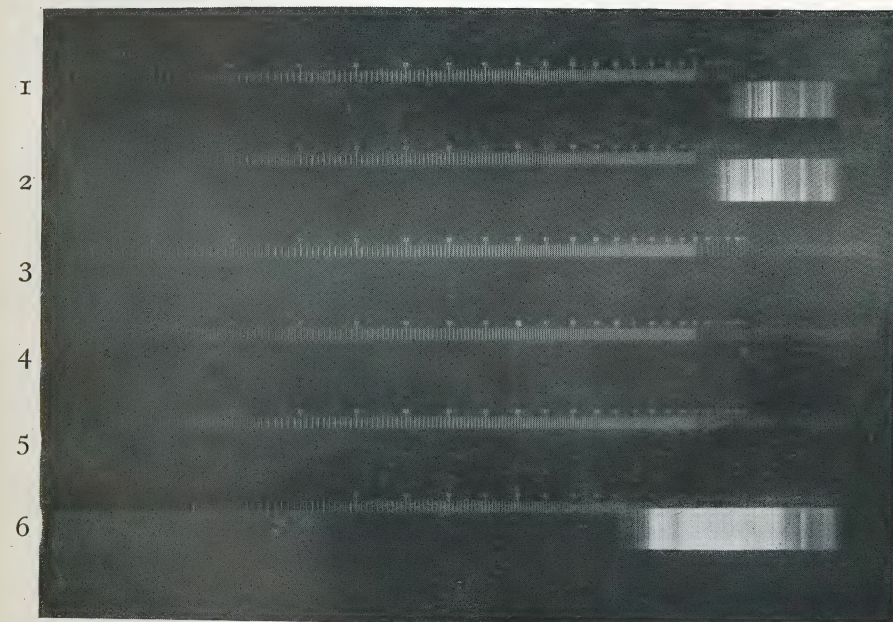


FIG. 27.—Glass Transmission of Ultra-violet.

[To face p. 54.]



in goggles. Results in each case are identical, and show a definite transmission extending down to 3,500 Å.U.

The particular point of interest is the fact that Crookesite and Crookes A are made under practically the same formula, and in appearance are much like crown glass, except that when looked at edgewise they have a slight flesh tint.

This is by no means the case with Crookes B2, which is pronounced smoke-colour, and when laid on a white surface is quite dark.

Remarks on these three forms of glass must not be taken to mean that the glasses are unreliable. The fact is that Sir William Crookes' glass is intended for use in spectacles and eye-glasses to cut down the transmission of ultra-violet rays present in sunlight, etc., and constitutes a remarkable achievement, as the desired object was to produce a glass as nearly colourless as possible, at the same time absorbing practically all of the natural ultra-violet rays and not an excessive amount of glare of visible light.

Fig. 27: No. 1.—Fieuzal No. 4 tint, a glass much favoured, as it has a particularly pleasing green tint. It definitely transmits ultra-violet rays down to 3,800 Å.U., therefore is not quite safe to use.

No. 2.—Amber. Definitely transmits ultra-violet rays down to 3,650 Å.U. Not to be recommended, because in addition it is apt to intensify visible radiations.

No. 3.—A piece of Arkos (registered) glass. Complete obliteration of all ultra-violet.

No. 4.—A piece of Saniweld. Likewise complete obliteration of ultra-violet.

No. 5.—Noviweld. Complete obliteration of ultra-violet.

No. 6.—An optically worked piece of crown glass, 2 mm. thickness, showing that it does transmit ultra-violet rays to the extent of 3,050 Å.U.

The foregoing should clear up much that is misunderstood of the various glasses on the market, and prove of great



interest to many, as the writer believes that this is the first serious attempt to deal with this subject in a technical manner.

### GOGGLES

There are many forms of goggles on the market, a few of which are illustrated. First cost should not always be the deciding factor, and unquestionably the goggles purchased should be sterilisable, as it is quite easy to transmit disease from one patient to another and the results of this may be very alarming.

Many women object to using goggles, as towards the end of the treatment they sometimes leave white marks or rings round the eyes. There is a light and well-made face shield on the market, which is admirably adapted to prevent this—the Fleming model No. 500. (Face mask.)

### SUITABLE GOGGLES TO WEAR.



FIG. 28.—Wellsworth Hardy Goggle. Pfund gold-plated lenses (sterilisable).

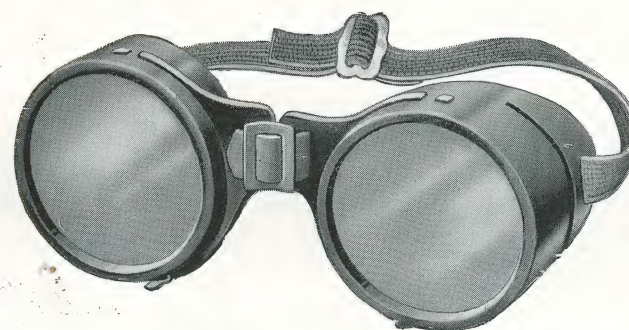


FIG. 29.—Wellsworth Model 444. Saniweld lenses (sterilisable).

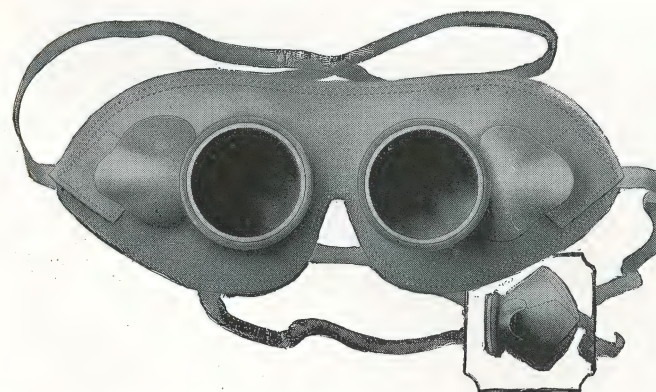


FIG. 30.—Fleming Model. "Absorbo." Note ingenious ventilation.

[To face p. 56.]



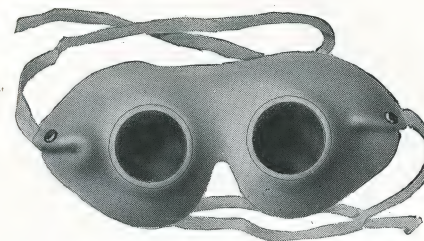


FIG. 31.—Fleming Model. "Absorbo." Suitable for infants.



FIGS. 32 and 33.—Model 500 Face Mask.

[To face p. 56.]



## CHAPTER IX

### DOSAGE

Dosimeters—Variation in electrodes—Infra-red and erythema—Use of constant testing.

It is noticeable that whereas nearly all those writing of ultra-violet radiation have something to say on the subject of dosage, some merely treat the matter cursorily, and others give a good deal of attention to explaining how important it is. While this is undoubtedly an important subject, it is impossible to do it full justice at the present stage of ultra-violet treatment.

Until an electrode is devised which can be guaranteed to give a constant and steady output of ultra-violet ray (and this is highly probable in the near future) too much attention should not be given to the many and varied dosimeters now in use. All dosimeters must be regulated by the output of any particular electrode or lamp, whether of tungsten, metallium, or mercury vapour. By far the steadiest ultra-violet ray is produced by the last; the others vary enormously, as has been shown in the chapter on electrodes and their output under given tests, so that very little reliability can be placed on them.

Allowing that dosage is regulated by the quantity of ultra-violet ray produced by any given electrode, how is a particular dosimeter involved, seeing that at present all electrodes vary not only from day to day, but from minute to minute?

Take, for example, tungsten: with an amperage of 4, we



get a rich output of long-wave radiation. Watch it under the spectroscope, and note how it varies in a period of twenty minutes. In testing a patient for dosage, and having, say, five areas to be treated, ranging from one to five minutes, the first three may get a rich output of ultra-violet ray, and the last two a poor one. Therefore the test breaks down because the last two areas should be getting a much greater quantity of ultra-violet ray owing to the longer exposure.

Another factor that is seldom taken into account, is that all electrodes give off a considerable amount of infra-red. This latter ray has been more or less ignored so far, but it is well known that infra-red plays a big part in producing erythema on the skin—possibly as much as the ultra-violet ray—and it has certainly been known to cause bad corneal ulcers. Therefore, unless a screen is used to cut off all infra-red, we cannot obtain a true dosage. So far, the writer has not observed any mention of this fact by those writing on the subject.

Until an electrode is produced giving a constant output of ultra-violet ray, and until the infra-red is screened off, these dosage experiments can be hardly relied upon to any extent. At present, the best guide is an individual experience of practical results, ignoring, or at any rate not depending solely on, the "dosage" obtained with a dosimeter alone.

Making sure of the output of an electrode can only be done by constantly testing the lamp—not by any chemical test, which has been shown to be unreliable, but with an actinoscope. The working of the latter gives reliable results when thoroughly studied and understood.

Testing with the spectroscope is, of course, another sure method, but this instrument is, generally speaking, beyond the means of most of those practising actinotherapy, and up to the present there is no inexpensive and at the same time reliable make on the market.

## CHAPTER X

### TECHNIQUE

Necessities for working this ray—Room—Robes—Constitution of room—Radiant heat for patients—Testing switchboard—Insurance—Time for treatment—Patients under treatment—Erythema—Home treatment—Overdose—Patient's colouring: idiosyncrasy—Position for treatment—Classification of erythema—Treatment: when, and how often to be given—Preparation of skin—Covering face and eyes—Protection of surrounding skin—Care of lamps—Methods of giving treatment—Mercury vapour lamps—Kromayer lamp—Quartz rods and applicators—Carbon arc lamps—Combined carbon and tungsten lamp—Tungsten arc lamps—Composition of reflectors—"Don'ts."

**Necessities for Working this Ray.**—In taking up this work, whether practitioners intend to specialise in it or run it with their general practice, there are four things necessary.

1. They should have a good all-round knowledge of the subject of ultra-violet ray.

2. To obtain a lamp or lamps that are easy to work, with a thorough knowledge of the working of same.

Treatment is so often given by people who know nothing about their apparatus.

The writer knew a practitioner who gave a treatment when there were no electrodes in his lamp, and when remonstrated with he said: "What's wrong? It went perfectly!" It certainly did, but he did not know that the current was simply jumping from the positive to the negative terminals on the lamp itself, with no ultra-violet ray being given off.

3. Obtain some knowledge of electricity, if only the



rudiments. Very few medical men know anything about electricity.

4. Make sure that the room is suitable, with regard both to size and heating facility.

**Room.**—It should not be too big, but big enough to enlarge the scope if necessary, and in which to move round easily. For those cramped for space, a lamp swinging from the ceiling on a runner, working parallel to the patient, is most convenient, in order to operate upon any part of the patient without moving him. The lamp should also be made to be raised or lowered at will.

With regard to the arrangements of the treatment-room, it should, if large, be partitioned off into treatment areas and several dressing-rooms. The walls should be plainly distempered or papered, the room free from unnecessary furniture, and no curtains hung, except perhaps on doors. The room should look bright and comfortable. The writer has heard of some treatment-rooms which are hung with heavy black curtains, giving them a weird appearance, and rather alarming to a highly sensitive nature. If curtains are considered necessary, let them be of a pleasing type, for the great effect of colour on the mind is now recognised. Red frequently acts as an irritant, black is depressing, blue and green are soothing, and yellow stimulating. It is highly desirable to keep the patient in a cheerful state of mind.

**Robes.**—As patients must be undressed for the treatment, robes are, of course, necessary. A simple and practical arrangement is to have a number of these robes, each of a different colour, so that the patient can keep his own or her own particular robe until the treatment is finished, when it can be laundered.

**Constitution of Room.**—Avoid carpets or rugs. The best flooring is of polished boards, they are easy to clean and are sanitary. If using tungsten, carpets especially get soiled very quickly and fade. Also there is the risk of red-hot

metal dropping on them and burning holes. That walls and ceilings should be painted or distempered is specially necessary, as it will be found that tungsten, steel, carbon, or carbon-cored electrodes give off considerable fumes, causing blackening very quickly, making it most difficult to keep them as nice as one would desire.

A portable couch is a necessity, and should not be too low if massaging is to be given. A low couch makes back-aching work for the operator. Each couch should be covered with a clean washable cover—a cover for each patient, to be kept with his robe in a separate pigeon-hole bearing his name. Little attentions like these make a great difference to fastidious patients. The idea of the different coloured robes is suggested, as some patients are very superstitious of certain colours, some disliking green, some yellow, and so on.

**Radiant Heat for Patients.**—If using a mercury vapour lamp, remember that this lamp is somewhat cold, and does not give out enough heat to keep the patient warm.

Therefore a large radiant lamp swinging from the ceiling should be fitted, and so adjusted that the centre of the lamp is directed to the middle portion of the exposed part of the patient's body.

These radiant heat lamps should be from 1,500 to 2,000 candle-power. They give out a very great heat, and are very cheap to run. The reflector itself should be oblong in shape, though why these are mostly made round it is difficult to imagine. It is far from the best shape, heating the patient too much in one part of the body, and not enough in the others.

The writer has had made for him by his instrument-maker (Mr. Stanley Cox, 30, Percy Street, W.) a lamp 2 feet 6 inches by 18 inches, made of a bright tin, light in weight, and so constructed that it can be tilted backwards and forwards at will. He finds that this diffuses the heat better, and keeps the patients warm all over. These lamps are essential, not



only for heating purposes, but because they cause a dilation of the surface capillaries all over the body, and thus more ultra-violet ray is absorbed than if it is given without external heat. Further, the brilliant light given off is beneficial to the patient. As is known, a clear bright light contains all the colours of the spectrum, and it is now accepted by most of the profession that colours play a great part in the cure. All lamps give off the colours of the spectrum, and it is acknowledged that ultra-violet ray in itself is not always enough, without combining some of the other colours.

To prove that the sun contains non-beneficial colours, we have only to lie in brilliant sunshine and expose the body to an overdose of these rays to find how bad they can make even a healthy person feel.

**Testing Switchboards.**—See that the switches are of the best. When very busy, there is nothing so annoying as the delay and inconvenience caused by a faulty switch, as the writer has experienced more than once. The two-pole switch is the best; and have the fuses readily accessible and easily removable.

The fuse consists of a porcelain plug containing the fuse-wire, and should be so constructed that it is easily mended without having to turn off the current at the main. Another small item that is mostly overlooked by the inexperienced in starting this work, is to make sure that the circuit-wire is large enough to carry the amperage required. It is as well to have it installed to carry more than the current required under any circumstances, and see that this is in good lead covers. Remember that the current in use is sometimes considerable; if a fire should occur, and the system has not been passed by the local county council, the insurance company will repudiate the claim.

**Insurance.**—While on this topic, those practising in this work should be reminded that it is advisable to take out an insurance against all accidents to a third party. It

may happen that a lamp will break, and a patient possibly be badly burnt, or one may fall and injure him, entailing liability for heavy damages. The writer well remembers such an accident nearly happening in his own treatment rooms. The nurse was about to put the patient on a carbon lamp which was generally suspended over him, when down it came in her hands! Fortunately the patient was not yet on the couch, or it would possibly have caused serious injury. It is advisable to insure against such possibilities.

**Time for Treatment.**—The question is often asked as to which is the best time to have an ultra-violet ray treatment—whether before or after meals? It is best not to have it too soon after a meal. It must be remembered that we try to bring as much blood to the surface as possible, drawing it from the innermost parts of the body. If a radiant lamp is applied to the whole surface of the body just after a meal, it necessarily must draw the blood from the digestive organs and cannot be good. An hour to an hour and a half after meals is safe for treatment.

Some patients are extremely nervous about having ultra-violet ray. They think they may be going to have an electric shock, but if they are shown exactly what is to take place, and it is explained to them (and especially to children), there will be no difficulty.

**Patients under Treatment.**—Another precaution: never leave a patient when under treatment, no matter how many treatments they have had. One never knows what might take place, especially when using lamps of the mercury vapour pattern. Should a sudden break occur, and red-hot mercury escape and reach the patient (this is unlikely but not impossible), it would be very disastrous to patient and practitioner, therefore always insist on a thoroughly qualified nurse staying by the patient during a treatment. Some use a clock with an alarm, and set it for each treatment. This is useful if giving more than two treatments in the same



room on different lamps, but not necessary if the nurse is personally looking after her case.

**Erythema.**—Patients should be warned that possibly some four or six hours after the treatment an erythematous rash may break out on the skin. This varies from a slight redness to severe inflammation, and indeed, it may sometimes go as far as to cause a blister. This, however, is very rare, and the patient can be assured that even if all the skin peels off, which very constantly occurs, no scarring will eventually take place. He can safely be told that the skin will be in a better condition than before. In a number of diseases it is absolutely necessary to get this erythema if you want good results, but it is rarely necessary to go beyond the third stage. This is disputed by a certain number of workers in ultra-violet radiation, but one cannot go against facts. The more cases treated the more it is emphasised that if results are wanted, it is necessary to go as far as third-degree erythema in certain classes of cases. For simply giving a toning-up bath it is not necessary, but in severe eczema, psoriasis, rheumatism, etc., we cannot get the best results without bringing out erythema.

**Home Treatment.**—This has become very fashionable lately, and as time goes on it is possible that it will be the correct thing to have a lamp in the home as much as a bath, but until the public knows how to use these lamps, they are a source of danger rather than of healthgiving.

There have been several cases published—one particularly, in the *British Medical Journal* of April 11, 1925, by Drs. MacCormac and McCrea—showing the serious results of home treatment undertaken by a patient who knew practically nothing about the subject, and who gave himself the treatment daily. Unfortunately, on one occasion he fell asleep for one and a quarter hours, with dire consequences. Here is an example of a treatment with no one in the room. Had there been some one with him, this could not have happened.

The writer is strongly of opinion that no one ought to take these baths except under medical direction. It is most important to give the correct dose, and only those used to working with ultra-violet ray are able to estimate what that is.

**Over-dose.**—What is an over-dose of ultra-violet ray? That is a difficult question to answer, and one can only arrive at a conclusion by experience. Patients differ—never more so than in the dose of ultra-violet ray that they can take.

There are instruments made to regulate the dose, called dosimeters, but except to show what erythema a certain dose of the ultra-violet ray will bring out on the skin, the writer at the present stage has little use for them. What we want to know is the exact dose that each patient can stand, constitutionally, and so far no means known to the writer have been introduced to ascertain this, nor will they be, until we know a great deal more of this ray than we do. The only means we have is the treatment of each patient individually, giving the initial dose with great caution, and gradually working up to the maximum.

**Patients' Colouring.**—Again, in giving these doses, a number of things has to be taken into consideration, the first of which is the patient's colouring. Dark patients take more than fair, on the same principle that the negro races can stand any amount of the sun's rays because their skin does not absorb them, owing to the black pigment with which nature has provided them. A fair person contains very little, if any, of this pigment, and absorbs the rays very readily. Therefore, care must be taken in first exposures, until the skin becomes used to the ray and slightly pigmented, which prevents an over-dose.

**Idiosyncrasy.**—Again, some have an idiosyncrasy to ultra-violet radiation, and the ordinary dose on these people will create intense erythema and sometimes make them



exceedingly ill. If the patient is a woman, she will very probably not repeat her visit.

See that the lamp is not too near. If you are using a mercury vapour lamp, the initial dose should not be for longer than three minutes in all, and the lamp not nearer than 3 feet from the nearest contact with the patient's body.

**Position for Treatment.**—It is advisable to give him half anterior and half posterior treatment. A very good method is to make him lie partially on his side, so that he gets the full blow of the light. A glancing blow is never as effective as a direct blow, and in this attitude the position of the body is such that it gets the light equally all over it, whereas, if the patient is lying on his back or stomach, one part of the body must be nearer to the lamp than the other, and this causes unequal erythema.

When treating a case of eczema, for example, with patches more or less irregularly all over the body, it is well to give a general bath first, then each eczema patch should be taken separately and a slighter bigger dose given. This can be accomplished by bringing the lamp to within a foot of the patient, and giving a minute or two minutes as required. Take care to cover the rest of the patient, and only expose the patch to be rayed, otherwise an overdose is a certainty. Some patients not only have an idiosyncrasy to this ray, but are affected constitutionally as well. They state that they were prostrate after the bath, and that it occasionally makes them sick.

In the *British Medical Journal* of February 13, 1926, Dr. Paige Arnold mentioned a peculiarity which occurs in certain individuals exposed to what is otherwise a normal dose. To quote his own words:

"After a general irradiation, there is marked lack of that feeling of general well-being, and the usual exhilaration is replaced by a feeling of depression. Following a latent

period of two to four hours after exposure, headache, a feeling of chilliness, pain in the back, conjunctival irritation, nausea with occasional vomiting, distaste for food, and general depression ensue. Diarrhoea is an occasional concomitant. The next day brings general lassitude with vague depression, which gradually passes off. The condition appears to occur in one out of twenty-five patients treated. It has been met with at all ages, in women more than men, and chiefly in dark or red-haired persons. No reaction has been observed in any blonde, etc. . . . These phenomena were first observed when using carbon arc lamps with cored carbons, but the same effects have been observed with tungsten arc and mercury vapour lamps."

Dr. Arnold must have encountered a number of cases giving these untoward symptoms, as may happen now and then. The writer has given some thousands of treatments, and has never once met with this class of case, either in blonde or dark-haired people.

That this occurs in one out of every twenty-five cases is most decidedly not the case. Nor has the writer heard of other medical men with considerable practice in these rays having a similar experience. In a thousand treatments, these cases would have been met with, if they are as prevalent as Dr. Arnold states.

However, it all goes to show how carefully the dose must be regulated at first, and that it is not a ray to be played with by the general public in their own homes. No one should be allowed to use this ray for purposes of treatment except under expert advice.

**Classification of Erythema.**—Erythema varies, and may be classified under four headings.

1. Slight degree of redness, followed by little or no desquamation of the skin, obtained by a mercury vapour lamp after one and a half to two minutes' exposure at a distance of 30 to 36 inches.



2. Slightly more reaction, followed by a mild irritation with desquamation; two to four minutes at 30 inches.

3. A more severe reaction, accompanied by intense itching and burning, and later by peeling of the skin in large flakes; four to five minutes (or even less in some cases), at 30 inches.

4. Lastly, destruction of the skin, leading to swelling and blistering; eight to possibly ten minutes at 30 inches. This last is very rarely necessary except in small patches, *e.g.* in a case of *nævi*, etc.

These doses do not refer to those who have an idiosyncrasy to the rays. They are an average dose.

Always begin with a very mild dose, and feel your way carefully. Then, after two or three doses, you can increase more rapidly if necessary. In some cases pigmentation of the skin soon takes place, and thus forms a barrier against an over-dose.

*The first and second degrees* are used for general irradiation, and are required for constitutional treatment, such as for neurasthenia, toning up after influenza, severe illness, or for a general tonic effect. The length of exposure is gradually increased, dose by dose, as the skin pigments—some opinions advocate up to half an hour back and front, but such long exposures are not necessary if a mercury vapour lamp is used. With a carbon lamp, on the contrary, treatment can be given up to an hour or more.

*The third and fourth degrees* are used for local condition, *e.g.* rheumatism, neuritis, lupus, and *nævi*, where destruction of abnormal tissue is desired.

**Treatment: when to be Given.**—The general practitioner may next ask how often these baths are to be given. Certainly not every day. Each patient should be treated with the ray not oftener than three times a week at most. For a general rule, twice to three times a week is quite enough. This ray has the power of accumulating in the system, and giving itself out gradually.

Most medical men practising in this ray have come to accept the principle that forty-eight hours should intervene between each treatment, if the full value of the ray is desired. Patients should be warned against taking a hot bath after one of these treatments, if they do they may expect to feel a considerable stinging and burning. After forty-eight hours this will usually pass off, when a fairly warm bath may be taken.

**Preparation of Skin.**—Before irradiation the skin should be thoroughly cleansed from all greasy matter and powder. Scales and crusts must be separated and removed, and if the scalp is being treated, the hair should be cropped as closely as possible, or better still, shaved, as every hair casts a shadow over the affected part.

The skin has a great power of absorbing the short wavelengths of ultra-violet rays which act bactericidally, and it is these rays which cause the erythema.

In treating deep-seated skin lesions, such as lupus, when the greatest amount of rays is necessary to penetrate the tissues, a quartz compressor should be used to make the part anæmic and prevent the rays being absorbed by the blood.

It will be found that the skin is more susceptible to ultra-violet ray than the mucous membranes of the body, and a longer and closer exposure can be used on the latter with the mercury vapour lamp or tungsten arc.

**Covering Face and Eyes.**—Some patients, particularly women, object strongly to the ray playing upon their faces. This can be easily avoided by covering the face with a handkerchief, or better still, by using a face-mask made of tissue paper guaranteed to keep the ray out. These masks can be obtained from Mr. Stanley Cox, 30, Percy Street, W., and are so inexpensive that they can be discarded after use. The eyes are an important feature to remember, as exposure for five seconds is enough to cause conjunctivitis, with its concomitant symptoms appearing some hours after treat-



ment—generally when the patient has retired to bed. If this should occur, it generally suffices to place ice-packs over the eyes and bathe them with a boracic solution. If pus is present, argyrol or protargol should be used, and the patient confined to a dark room. Occasionally the pain has been known to be so bad that it was necessary to inject morphia, but this is a very rare occurrence.

There are certain glasses obtainable at Messrs. R. Fleming's which, if used during the day or in artificial light, are very soothing to the eyes. Within a few hours of wearing them all irritation disappears. The writer has never known any actual harm come of an exposure, but it can be exceedingly painful, therefore every patient should wear goggles (see chapter on this subject) during treatment. Great care should be taken that they fit accurately to the eyes. If they do not, the ray may penetrate at either corner, and result in a very bad night for your patient.

**Protection of Surrounding Skin.**—If only a local treatment is given, protect the surrounding skin with black or red paper, or even tin-foil, but we have never found it necessary to go as far as that. Any cotton material, or the wrap the patient is using for a covering, which is fairly thick, is generally sufficient, as ultra-violet ray is completely absorbed with either material, therefore it is the most satisfactory to employ. Unless otherwise necessary the genital organs should be covered. Occasionally, in cases of bad eczema, these have to be exposed to the ray.

**Care of Lamps.**—The life of a lamp, and especially a mercury vapour lamp, is greatly prolonged by the way in which it is handled. If treatments follow each other in fairly rapid succession, avoid switching the lamp on and off. Damage is far more likely to occur to the lamp than if it is allowed to burn continuously. The burners, however, only have a certain length of life and should not be kept burning unnecessarily.

**Methods of Giving Treatment.**—There are several methods of starting treatment, and medical men differ in their modes of application. Some give the two or three minutes' treatment, half anterior and half posterior, so as to distribute it well. Others adopt the method of giving first exposure to the feet, second to feet and calves, third up to the thighs, gradually working over the whole body. This is called "fractional irradiation," suggested by Professor Leonard Hill. It is difficult to know what object is claimed for this, except that in phthisis it possibly might be better than raying the whole body. It is a disputed point in this disease whether patients should have it when there is a tendency to bleed, or when they are far advanced in the disease. The question must be left to the discretion of the doctor.

If the patient is suffering from headache, it is better not to ray the head.

**Mercury Vapour Lamps.**—Of these there are two types—water-cooled Kromayer and air-cooled. They are both extensively used. For local application the former is preferred. However, in skin affections, such as eczema, psoriasis, etc., the open mercury vapours variety is just as good, and except in much local work it can be adapted to almost all cases. The disadvantage of the closed lamp is that an area only the size of the window (2 inches in diameter) can be treated at once, therefore cases with large surfaces possibly of 3, 4, or 6 inches in diameter, or those with irregular surfaces, are best treated with the open lamp, the surrounding area of the body being covered with paper or lead-foil. The lamp in these cases should be held about 6 inches from the part, and an exposure of some minutes given. This will cause a good deal of erythema and soreness, but further treatment should not be undertaken till this has faded, which it does as a rule in about four or five days, when another dose may be given of slightly longer duration.



**Kromayer Lamp.**—For deeper work, the Kromayer lamp with a quartz window may be used, and sufficient pressure applied to cause exsanguination of the part, and so obtain greater penetration of the rays. This class of treatment is generally used in lupus and naevi, and the exposure varies from six minutes up to possibly twenty.

Before using the water-cooled lamp certain precautions should be taken. See that the water is running, and when the treatment is finished, turn off the current first and then the water. Further, it is advisable not to allow the water to flow away, but keep it in the lamp till the quartz has cooled, in order to prevent cracking. The metal jacket of a water-cooled burner should never be allowed to get too hot. To be able to hold it in the hand is a good test.

**Quartz Rods and Applicators.**—In treating the ear or nose, quartz applicators are specially made of different shapes and sizes, which are fixed to the window of the lamp. For treatment of certain orifices, quartz rods have been designed, or hollow cone-shaped applicators, specially fitted with water-cooling devices, for the vagina, rectum, and mouth-work. Very little ray intensity is lost at the distance between the burner and the parts under treatment when using these devices, as quartz is known to conduct the rays better than the air. A very important point when ordering these applicators, is to make sure that the angle at which the quartz is bent is not beyond a right angle, otherwise the ray will not follow. The writer recently saw one in which the ray could not follow the bend. This is apparently a small item, but an exceedingly important one.

Professor Kromayer has invented a method of cutting off the excessive heat in non-penetrating short wave-length ultra-violet rays by applying varying thicknesses of blue Uviol glass with a perforated metal holder between the quartz window and the cover of the burner, this itself being in the

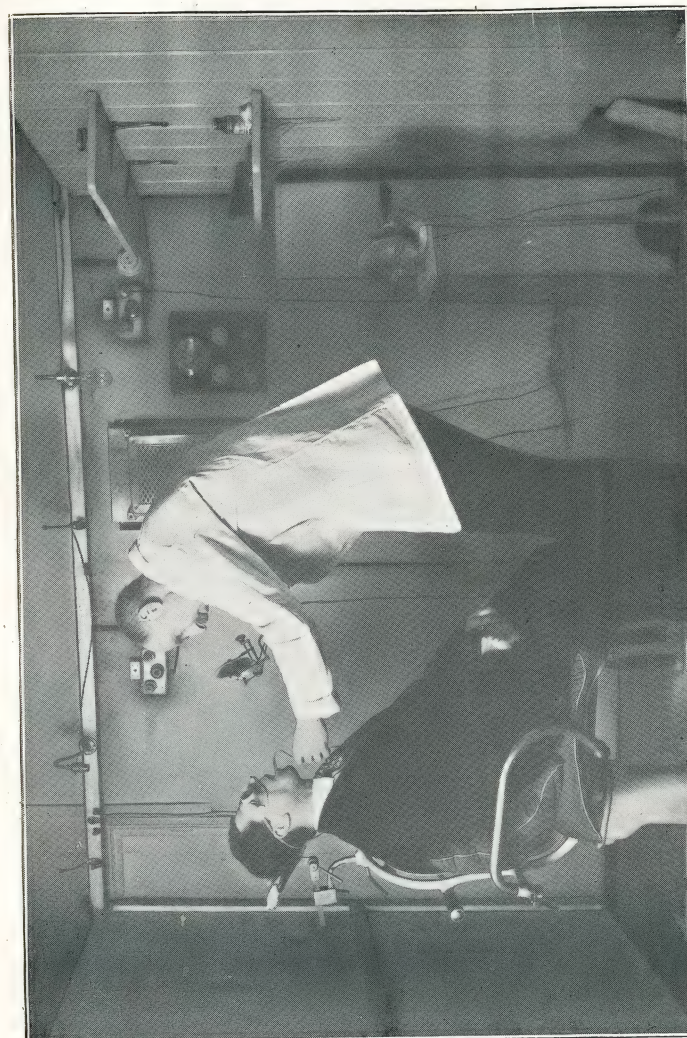


FIG. 34.—Irradiation with Small Local Lamp (gums, tonsils, etc.).

[To face p. 72.]



water. The blue, violet, and short wave-lengths are thus allowed to pass through the screen, the heat, red, and ultra-violet rays of short wave-length being absorbed. The amount of absorption would depend upon the thickness of the screens used.

**Carbon Arc Lamps** are still extensively used in conjunction with tungsten or some other richer metal giving more ultra-violet ray. They are very useful and good results are obtained. The oldest form of arc lamp is the old street lamp of many years ago. There are several designs of these on the market. They have the advantage (if it is one) of being self-fed. It is found best to combine carbon with some other metal for obtaining pure ultra-violet ray. The difficulty was how to combine the two, but this lately has been overcome by the carbon core. Each carbon contains a thin pencil of compressed tungsten, or compressed iron filings, which gives out a rich quality of ultra-violet rays. But it must be borne in mind that most of these carbon-cored metals have an unfortunate habit of spluttering badly and casting off minute particles of red-hot metal, which is decidedly objectionable to the patient. Furthermore, it has been found by the spectroscope that the output of ultra-violet ray is diminished whilst this spluttering is taking place. Another method is with a lamp which combines tungsten or carbon together or separately. Having them in combination does away with the necessity of moving the patient from lamp to lamp, if it is desired to give carbon and tungsten at the one sitting.

**Combined Carbon and Tungsten Lamp.**—The writer has designed a lamp to meet this need (see chapter on Apparatus), which can be worked with carbons only, or with carbons and tungsten or metallium. This gives out an extremely rich supply of ultra-violet and does away with moving the patient unnecessarily when once under treatment. This lamp is fitted with two electrodes of carbon, and



one of tungsten. The tungsten should not be of more than 5 amperes, and the carbon 10 or 15 amperes, which is enough seeing that there are two pairs working. Begin with ten minutes on the carbons, switching on the tungsten for the last five minutes. The dosage should gradually be increased till you are giving tungsten for ten or twelve minutes and carbon up to thirty minutes, the focal distance being about 18 inches to 2 ft. This lamp is so arranged that it does not overhang the patient, therefore, if the latter is reclining, which he generally is, make him lie partially on his side. He then gets the light directly on the anterior or posterior portion of the body.

Excellent results have been obtained with this lamp in such cases as pronounced neurasthenia, exhaustion after influenza, lupus with local treatment, and operations. This type of lamp is entirely employed for general body treatment, and should be used for one patient at a time. It is not for clinics, though there is no reason why a bigger lamp on the same principle should not be constructed for clinical work.

**Tungsten Arc Lamps**, with concave reflector behind, are the ones generally in use now. There are several types on the market, of which the commonest is fitted on a stand. It can be lifted off and held with a handle, which facilitates moving round the patient and raying any particular part.

The apparatus used by the writer, for general local purposes, consists of a concave mirror moving to and fro from the arc, so that the reflection on the patient can be brought to the size of a shilling or 2 inches in diameter. This is connected with the main, a resistance being fitted to suit the circuit. Tungsten or metallium is generally used for local work, being richest in ultra-violet.

**Composition of Reflectors.**—It is of the greatest importance that the reflector should be composed of the right metal, for the amount of the ultra-violet will be

reflected on the patient accordingly. The reflector should be fitted behind the arc, and should be made of silicon, which is said to reflect 75 per cent. of ultra-violet rays.

Although application has been made to numerous firms, the writer has never succeeded in obtaining a silicon reflector. They all admit that it can be made, but unfortunately it has been impossible to prevail on them to make one.

Nickel reflects 45 per cent., while silver is said to reflect 6 per cent. only. To-day the majority of reflectors are coated with nickel.

In all cases where local lesions are being treated, the concave mirror may be used to focus the rays upon the part; in most cases a far quicker result is undoubtedly obtained by doing so. In cases of rheumatism or sciatica and such like, it is doubtful if as good (certainly not as quick) results are effected without using this method. Whether it is due to the infra-red rays also given out and reflected on the patient's body, or whether an extra dose of ultra-violet ray is forced into the patient, it is difficult to say, as there are doctors and scientists who maintain that the patient can only absorb a certain quantity of ultra-violet radiation at a given time. Whatever is the reason, give your patient the benefit of the doubt.

**Don'ts.**—There are a few points or don'ts the writer would like to emphasise before leaving this subject and, for the beginner, well worth remembering.

*Don't* place a lamp directly over a patient. One can never tell when it might explode, and if it happens to be a mercury vapour lamp, the result will be most unpleasant for both practitioner and patient.

*Don't* let untrained persons, male or female, give an ultra-violet treatment. Hospital training is not necessary, but they should be fully trained in the giving of ultra-violet ray treatment. Very bad burns have resulted through inefficiency, and as patients know when an attendant is not



equal to his work, it would be prejudicial to the ultra-violet ray treatment, and to the practitioner involved.

*Don't* omit to be well insured against accidents in your treatment rooms.

*Don't* be persuaded to give a longer treatment than you consider would be right the first time.

A woman who came to have some toning-up baths, told the writer that she had been lying in the sun for twelve hours at a time in the Soudan desert, and insisted she could stand a great deal of ultra-violet rays. The nurse inquired how much was to be given, and was instructed to carry out the usual rule: to give the amount that patients always received. The woman was somewhat indignant that she was not given a bigger dose, but three or four days afterwards, on returning for further treatment, she exclaimed, "Doctor, I have the greatest respect for your lamp—I am peeling like a python."

*Don't* give treatment oftener than forty-eight hours at the minimum, and frequently it must not be oftener than three or four days. The skin of the patient is the best criterion. If it is very sore and red, leave off treatment till the erythema dies down. In some cases of eczema and psoriasis, where big doses have to be given, it may be a week before treatment can be resumed.

*Don't* allow the patient, attendant, or self to come in contact with these ultra-violet rays, unless the eyes are protected with suitable goggles.

*Don't* at any time leave the patient when under treatment.

*Don't* forget to warn patients that erythema may come out five or six hours after treatment, and assure them that it will not do any harm.

## CHAPTER XI

### TREATMENT IN GENERAL

How to administer treatment—Effect of the rays on different patients  
—Chemical results of rays on patients, etc.—Effects upon certain diseases—Wave-lengths for destruction of bacteria.

As far as the medical profession is concerned, we now come to the most important part of ultra-violet ray.

The writer reluctantly has to state that this part has been greatly abused, not only by the medical profession but by the laity, and results and methods are claimed which in many cases cannot be maintained. All over the country clinics and unqualified persons are buying lamps, without any knowledge of how to work them, or of what cases are suitable, with the consequence that before long ultra-violet radiation will be liable to be discredited.

**How to Administer Treatment.**—As before stated, those using this ray should know (1) how to administer it; (2) the suitability of the case.

It therefore behoves those who really want to have good results with these rays in their practice, to study the subject first. Obtain every book possible on the treatment before attempting to buy a lamp.

Do not tell patients that miracles can be achieved in curing their sciatica, rheumatism, eczema, etc., in a few treatments (diseases that they have had possibly for years), or that they will never return again. Tell them that in all probability it will give them marked relief, but that possibly



from time to time, they may have to return for a few treatments, in order to keep up the good effects that the rays obtained for them. And, too, when using these rays, do not scorn the old-fashioned medicines. The best results are obtainable when the two are worked in combination.

**Effect of Rays on Different Patients.**—Remember that there will be patients on whose particular disease these rays will have no effect. With electricity, too, there are certain classes of individual to whom it is harmful. These should be advised that treatment would be ineffective. The writer has found, especially in rheumatic cases where the rays have no effect, that ionisation will most likely be of benefit, or possibly a combination of the two.

**Chemical Results of Rays on Patients.**—In selecting cases for ultra-violet radiation, there are several points to be borne in mind. Biological effects of these rays upon the individual. The rays are absorbed by the blood and carried to every part of the body. The chief general effect is increase of metabolism, stimulating appetite, and raising the whole resistance of the body. Great benefit results after acute illness, especially influenza, and in weakly children, in rickets, miasmas, etc. In certain micro-organisms, especially in the intestinal tract, ultra-violet ray is known to have beneficial results. The unstriated muscular tone is increased in bowel cases, and constipation cured when due to auto-intoxication. Hæmoglobin is increased, therefore all cases of anæmia and chlorosis receive benefit. The latter is now an almost unknown disease. In these cases, after three treatments a week for six weeks, it was found that the red corpuscles increased by 10 per cent., and the white corpuscles more than doubled themselves—quicker results than any drug can produce.

**Effects upon Certain Diseases.**—Rickets, a disease that has been found markedly deficient in both calcium and phosphorus, has been cured more quickly than with almost

any other method. Surgical tuberculosis, lymphocytosis, and almost all skin diseases, are amongst those cases claimed to be cured or greatly benefited by ultra-violet radiation.

**Wave-lengths for Destruction of Bacteria.**—Of wave-lengths from 2,960 Å.U. to 2,100 Å.U. (that is the short waves, although the penetrating power of such is small, *i.e.*  $\frac{1}{10}$  mm. of skin), these rays have a marked effect upon the destruction of bacteria. Varicose ulcers are greatly improved under the ray, and those cases that have resisted all other known methods take on healthy granulations, and heal up in a comparatively short time.

Lorand considered ultra-violet beneficial in cases of rejuvenation, due possibly to stimulation of the endocrine glands, particularly the thyroid and sexual glands. When run down and jaded, the writer knows of no better tonic than half a dozen baths of ultra-violet radiation, starting with two or three minutes back and front, and working up to ten or twenty minutes.

There is no intention of setting forth a tabulated list of all those cases likely to be benefited with ultra-violet ray, but all cases of skin diseases are benefited. The writer had in his own practice some cases which had gone from specialist to specialist with no permanent or even temporary benefit. After a course of ultra-violet radiation there was no sign of skin trouble, and letters have been received months afterwards stating that the good results had been maintained.

It can be safely said that all cases of rheumatism, acute or chronic, neuritis, sciatica, etc., will be benefited, if not cured. Still, one should always give a guarded prognosis to a patient in those cases that look the most promising. One often encounters a patient whom the ray does not benefit; it is difficult to state before treatment whether a case will respond or not.



Some authors have put carcinoma and sarcoma on the list of diseases receiving benefit from this ray, but the writer has never found these cases, as far as the disease was concerned, give any good results. Doubtless they were toned up, but that was all that could be said for them.

## CHAPTER XII

## SKIN DISEASES

Bactericidal—Body bath—Furunculosis—Actinomycosis—Frostbite  
 —X-ray burns—Granulating wounds: ulcers—Erythema Pernio  
 —Tinea—Tinea Versicolor—Pityriasis—Rosacea—Urticaria—  
 Leucoderma—Pruritis—Psoriasis—Rhinophyma—Erysipelas  
 —Eczema—Alopecia—Herpes—Acne Vulgaris—Seborrhœa  
 —Lichen Planus—Ichthyosis—Impetigo—Keloid—Nævi—  
 Simple Burns.

IF we look back and study the cases that have received benefit from this ray, the first thing that strikes us is that nearly all doctors claim to have obtained good results in skin diseases. Because of their superficiality one might expect this, but to treat skin disease superficially only rarely gives a permanent or lasting result. Ointments or lotions, combined with internal medicine, so far have given the best results. In using the ray, we should on occasion follow a similar procedure; *i.e.* combine the old method of drugs or lotions with the new ultra-violet rays.

**Bactericidal Effect.**—Again, we have the bactericidal effect of the ray assisting in the toning-up of the system generally, and the stimulating action on cellular growth. Chronic cases which have resisted all other methods begin to respond in a marvellous manner after half a dozen treatments of ultra-violet radiation; particularly such cases as indolent varicose ulcers, psoriasis, and chronic eczemas. Septic wounds and purulent discharges clear up very rapidly, healthy granulations forming, and the discharge becoming less and less after almost every treatment. It is not enough



to treat these cases locally; every case, systematically, should have the body bath, as well as the ray locally when found necessary.

**Body Bath.**—We must remember that if we want good results, it is through the blood that we have to look for them, and it is only by giving a body bath as a regular routine that we can expect them. Therefore, make a rule that every case should have the bath, and treatment locally if required, and results will be most satisfactory.

Abscesses, boils, and carbuncles, have been known to dry up under ultra-violet radiation, when treated before the formation of pus; but even after this, if the part is laid well open, and the ray applied twice daily for three or four minutes at a time, you may expect complete healing and resolution in a matter of days, as against weeks under other treatment. The method adopted for treatment of boils and carbuncles will be found under their respective headings.

In the writer's practice it is a rule always to give the general treatment (that is, a whole body bath) to every patient, no matter what the complaint may be, and then follow up with a local treatment if necessary.

**Furunculosis.**—The boil is caused by staphylococcus, which, gaining an entrance to a hair follicle, multiplies there, eventually breaking its way through the wall and leading to a deep thickening, in the centre of which millions of cocci are found in the necrotic "core."

It is a prevailing fallacy that boils only occur in those who are run down, whereas they are as often found in those of vigorous health.

**Effect on Cocci.**—When tested upon a culture of staphylococcus, at a distance of 10 or 12 inches, ultra-violet radiation, especially with the mercury vapour lamp, proves sufficient to kill the cocci in five seconds. If, upon the first irritation or small pimple forming, the ray be applied vigorously, it can nearly always abort it. If the boil has been

allowed to form and pus is present, the ray will help to bring it to a head quickly; if the boil be opened, the radiation accelerates healing.

**Poulticing.**—The old form of poulticing should be discouraged, as this soddens the surrounding skin and helps to spread the infection, causing secondary lesions to develop. In the case of successive attacks of boils coming out on different parts of the body, look for the cause. In all cases of boils, the urine should be tested for sugar, and if present, the required remedy applied; where not indicated to the contrary, you will find that when ultra-violet baths are given, the whole system is toned up. *Yeast* has the approval of many dermatologists and is worth a trial, the patient drinking every morning a tumbler of fresh yeast from the surface of the fermenting tun. Professor Simpson, in 1900, strongly recommended Levurine. When the system is very run down, this, with radiation, will give good results very quickly.

The mercury vapour with compression also gives quick results, but the radiation should be kept up for some weeks, two to three applications a week being given. The tungsten arc is also good, but unless the third or fourth degree erythema is given, the results will not be very satisfactory.

**Actinomycosis.**—This disease is found in those who are in any way connected with agriculture, or with the handling of hay or straw, and is due to a fungus found in them. The lesions on the skin which are usually secondary to deeper disease, are quite characteristic. The appearance has been described as a "blob." The granulations are like little sticky drops of a reddish colour, with fistulous openings from which issues a fluid containing little sulphur-yellow granules. It can be readily understood how, if ultra-violet radiation (and especially the short rays) has power to destroy bacteria, it should also destroy the fungus of actinomycosis. Not having personally come across it, the writer cannot say



much about it, and can therefore only quote from the experience of others. The mercury vapour lamp should be used, and a good erythema brought out with the local application. Start off with the general bath, from a distance of 30 inches; two to three minutes is enough to start with, gradually working up. Where the sinuses are bad, it is advisable to scrape them before applying the ray. Give iodide of potassium internally.

**Frostbite.**—These cases are occasionally met with—not so much in England as abroad. Only one case has come under my observation; a girl who had been spending her holidays in Switzerland, got caught in a snowstorm whilst climbing, and could not get back. Her fingers were badly frostbitten, and when examined, were quite white, and had no feeling in them. Her treatment consisted of general baths, and the ray played upon the fingers with the tungsten lamp for ten or twenty minutes at a time. This restored them to a normal condition after twelve treatments. As the skin of the fingers is fairly tough, the ray can be given very concentrated, and for a long time without any appreciable difference.

**X-ray Burns.**—Burns caused by X-ray are almost a misnomer now. Ulcers so caused are most difficult to heal, but happily these troubles are becoming things of the past, rather than of the present day. Several Paris doctors have obtained good results with ultra-violet ray treatment, but until its advent no treatment had much effect upon these ulcers; even now the treatment by ultra-violet ray is tedious. However, it is worth the result. Owing to its bactericidal action, the best results in these cases are attained with the mercury vapour lamp; the dose must be for second or third degree erythema, and the surrounding tissues protected. The two worst cases of X-ray burns met with by the author, one of which originated nineteen and the other ten years ago, were both serious, and their history is as follows:

*Cases.*—*Mrs. G.*, in 1906, was treated by X-ray over the whole abdomen for some internal complaint. In May 1925, when her daughter was under treatment for duodenal ulcer, she asked if she could have treatment for her X-ray burn. She was given treatment twice a week for ten weeks, and at the end of this time several of the small ulcers had healed, but one or two remained, though reduced to the size of the little finger nail. Unfortunately, for reasons not understood by the writer, her own doctor advised her to undergo an operation, and under this she died.

*Mr. S.* came with a history of having had X-ray treatment in 1915 for an internal tumour. He said the tumour was cured, but he did not know which was worse—the disease or the result of the treatment. When examined, he had two large deep-seated ulcers, 5 inches by 3 inches, and  $2\frac{1}{2}$  inches by  $1\frac{1}{2}$  inches, in the small of his back, one on either side, and almost every treatment had been tried, with no effect. These ulcers were very painful, suppuration was coming away freely, and one had a large slough. This patient had a few treatments—not more than ten altogether—but the result was decidedly encouraging: the slough was loosening and coming away, and the wounds looked healthy and granulating freely, when he left off coming for treatment.

*Method of Treating.*—It is very little use treating these cases unless erythematous doses are given. As an invariable rule, always give the general bath first to tone up the tissues, then the local treatment, applying it well over the wound and edges of the wound. One or two treatments a week are sufficient, but many months will be required to bring about the desired effect. It was unfortunate that in these two cases complete cures could not be effected, owing to cessation of treatment.

**Granulating Wounds: Ulcers.**—Chronic indolent ulcers from any cause, and also acute ulceration, can be greatly benefited by a second degree exposure to ultra-



violet ray. Varicose, diabetic, and perforating ulcers, in fact all ulcerations, of whatever origin, appear to do well under this ray. Tubercular ulcers, especially, heal rapidly.

Syphilitic ulceration has been included in this category, but without iodides and mercury in these cases ultra-violet ray could hardly be expected to stand much chance; in combination, very good results might be obtained. The general bath should be given, and a local dose upon the wound surface until the second degree erythema is produced. Healthy granulations will soon spring up, and the unhealthy foul discharge which is so often found in these cases rapidly disappears.

In varicose ulceration the intolerable itching is generally relieved after the second application. It must not be forgotten that good results are also often obtained from ionisation with zinc or copper coupled with the radiation. In those cases where a large surface of cicatricial tissue is present, it is better to soften the scar tissue with ionisation of chloride of sodium, diathermy, or even radium, before giving the ultra-violet rays.

Granulating wounds yield rapidly to the influence of radiation. The exuberant granulations become normal, and healing results by the stimulation of the epithelial growth. Care should be taken when giving the ray, that the surrounding healthy skin is not exposed to it; and as the new skin is formed, this should be covered and protected, as the subsequent exposures might act as an irritant. The best results are obtained from the mercury vapour lamp in all these cases, owing to the bactericidal effect of the short rays.

**Erythema Pernio.**—Here again good results are obtained with ultra-violet ray, which combined with the continuous or sinusoidal current, can hardly fail to cure. It is not necessary to give more than a second degree erythema, and six treatments, unless the chilblain is in a very bad condition.

**Tinea, Tinea Tonsurans, etc.**—In these cases also good results are obtained. In the tonsurans variety a second or even third degree erythema is desired; the hair should be cut very short (if possible shaved), as otherwise it prevents the rays from reaching the hair follicles.

Either a Kromayer or air-cooled lamp can be used (some people prefer the latter) and three to four minutes given, at the distance of a foot. In this variety, owing to the difficulty of getting to the hair roots, ionisation with copper, followed with the ultra-violet ray, should always be applied, thus making sure of the cure.

In this disease and its varieties, ultra-violet radiation far supersedes the use of antiseptic unguents in reaching the axillary, crural, and interdigital areas—areas which present great difficulty under ordinary methods. In deep-seated types of this disease, it is best to bathe the parts in hot saturated solution of Epsom salts before applying the ray, whereas in the superficial type the ray is sufficient in itself for the destruction of fungi and bacteria.

In **Tinea versicolor** the application of ultra-violet ray perhaps shows the best results, but, though highly superficial in character, generally attacks considerable surfaces of the body. In all cases of Tinea full doses must be given; this is a rule well worth remembering. Mercury vapour lamps should be used.

**Pityriasis**, meaning scaliness, is a disease which is fairly frequently met with, especially the Rosea variety. There should be no difficulty in curing this. Give the general bath with a mercury vapour lamp, especially over the part affected. A second degree erythema is sufficient. The German school believes that the Rosea type is of a parasitic origin. The itching is relieved, and the duration considerably shortened. The ultra-violet ray should be given three times a week, and mild antiparasitic ointments used during the intervals.

**Rosacea** can be very satisfactorily treated with



ultra-violet radiation, either with the tungsten, metallium, or mercury vapour lamp, giving the second degree for mild, and third degree for severe cases.

**Urticaria.**—Many writers state that this condition can be very easily treated with ultra-violet radiation, but this is not the author's experience. Very great difficulty has been encountered in these cases to obtain the desired effect, and in every instance it has been necessary to combine vaccines and dieting, to have any results. Ultra-violet ray alone rarely does good. In order to ascertain the root of causes that are so varied, one must go further into the matter than one can with the rays alone, therefore they should be tried in combination with vaccines and dieting.

**Leucoderma (White Skin).**—Of this variety of case only one has been met with in the writer's practice, and it must be admitted that the results were poor. A third degree erythema was produced, but without visible effect. Some writers on the subject claim to have cured these cases with ultra-violet radiation.

**Pruritus: General, Anal, or Vulval.**—No matter where the irritation is, before starting on a case one must try to find the cause. To give ultra-violet ray indiscriminately is to court disaster. Pruritus may be due to a variety of causes: to a parasite, pediculi, hæmorrhoids, worms, or fissure (a usual cause if in the rectum), to a vaginal discharge, or to that somewhat rare cause, "mental pruritus" (in which the patient suffers from the delusion that the skin is swarming with insects); but whatever the cause, it must be removed before the ray can be expected to relieve. Cases are occasionally met with in which there are none of these causes—here the ultra-violet ray steps in and cures.

**Latent Effect.**—To illustrate this, some two years ago the writer was asked to treat a woman suffering from a severe attack of pruritus vulvæ, for which no apparent cause could be found, nor any vaginal discharge. She was treated with the

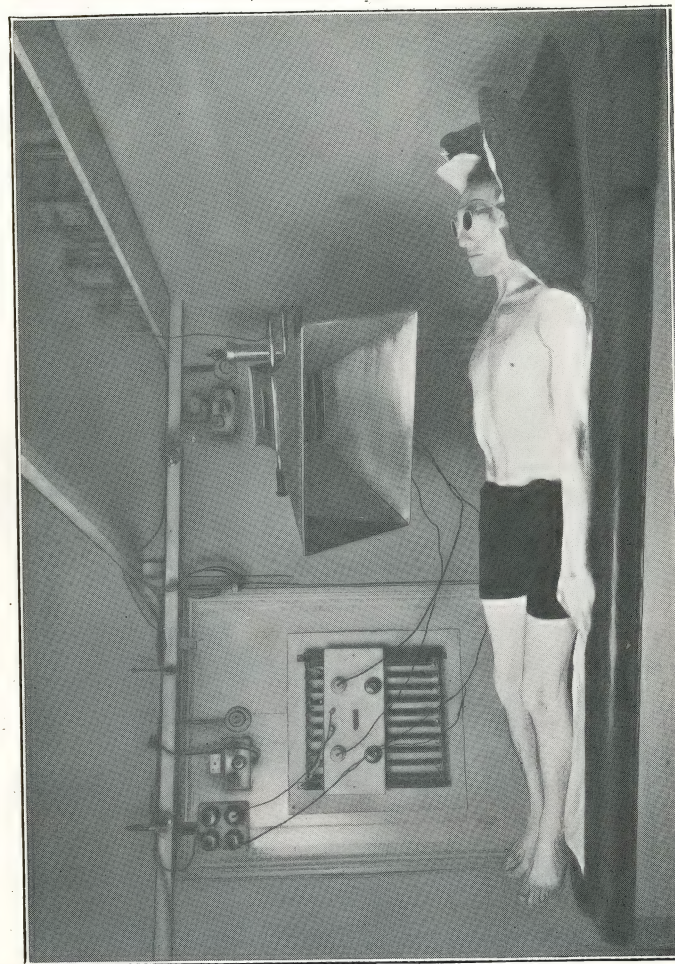


FIG. 35.—General Irradiation with Author's Lamp.

[To face p. 88.]



tungsten arc, and given a third degree erythema dose, which was followed up as the erythema faded ; but as very little, if any, result was effected, she was reluctantly discharged, as the trouble was thought to be incurable. However, less than a month afterwards, she stated that she was quite well. The irritation had gradually disappeared without any further treatment, which shows that the rays have a latent effect sometimes. This case is unusual, because results can generally be effected during the period of treatment.

*Anal or Vulval.*—If the irritation is anal or vulval, care should be taken to remove the hair, and to free the part of all ointments by washing with soap and water and thoroughly drying. The mercury vapour lamp is undoubtedly the best in these cases owing to its germicidal effect. In the vagina care should be taken that the folds or creases are removed. This can be done by placing the patient on the back in the lithotomy position ; all unaffected parts should be covered, and an erythema dose of the second or third degree applied. The patient should be warned that the part may be very sore for two or three days, and that she may have to stay in bed. However, it is surely worth while if a cure is effected.

**Psoriasis.**—It has long been known that this disease can be cured by exposure to the sun's rays, though it is rarely that any part of the body, excepting the hands, has been so treated. The question therefore arises as to whether the artificial ray can also cure it. Undoubtedly it can, and if time and care are given to cases, there are few, if any, that cannot be cured. If patients will only return for treatment when they suspect a recurrence, a few applications will keep them clear of the trouble. They should not imagine that it will never return, but if proper diet is observed, it should not return for a considerable time once it is thoroughly out of the system.

*Number of Treatments.*—Treatment should not cease the moment the symptoms disappear ; at least a dozen baths



should be given after all sign of trouble has gone, and patients should be advised to return after three months for a further course of about a dozen treatments, whether there are symptoms or not. Before irradiation, pursue the usual methods; remove all crusts and ointments. The mercury vapour lamp is best, and a third degree erythema necessary.

*In Combination.*—Another very useful practice to adopt when treating both eczema and psoriasis, is to damp the parts with saline solution. If this is done, it is found that the patient recovers quicker. All hairs should be removed and the surrounding parts covered. Some practitioners combine injections of manganese with ultra-violet ray, and claim a quicker result. Another good combination is that described by the writer in the section on eczema, *i.e.* the permanganate of potash and thyroid method, given either by the rectum or mouth; if by the latter, it should be given morning and evening with a pint of hot water. It will be found that the spots and scales appear much more slowly after about six to eight treatments. These gradually disappear. It takes a considerable time to clear up one of these cases, especially if it is very bad. Therefore the patient should be advised not to be despondent if good results are not immediately forthcoming.

**Rhinophyma.**—Great improvement has been claimed in the treatment of this disease with ultra-violet rays, using a second degree erythema. Though the writer cannot speak from experience in these cases, there appears to be no reason why there should not be good results. Appropriate dieting is also helpful.

**Erysipelas.**—This inflammatory affection responds very well to ultra-violet ray, the air-cooled or water-cooled lamp being used. Sometimes the pain can be relieved very rapidly, and if followed up in twenty-four hours with another dose, the latter soon results in arresting the disease.

**Eczema.**—There are so many cases called “eczema,” both by the medical profession and the laity, to which in the widest sense of the word this term could never apply. One authority states that “eczema is the term commonly applied to any wet or scaly inflammation, of the cause or nature of which the observer is ignorant.” This is undoubtedly true, for patients frequently come to the writer for treatment, with a diagnosis of eczema, whereas, upon going carefully into the case, it cannot be substantiated. The drugs that have been tried upon this disease are legion—some beneficial, others of not the slightest use. There is possibly no disease, which from time to time in one’s practice has given more trouble, and until ultra-violet radiation became known and appreciated, many cases had to remain uncured. Quite recently, two cases, stated to be incurable eczema, were sent to the writer; both cases after twenty to twenty-five treatments, were discharged cured. All kinds and conditions of eczema cases pass through our hands, and it is rare not to be able to cure or benefit them. By that, we do not for one moment mean that there will be no recurrence, but from the writer’s experience of all the cases treated so far, none has shown any return of symptoms.

*Form of Ray Used.*—The question arises as to what form of ultra-violet ray should be used—long or short waves. There is only one answer to this—the short waves, particularly those obtained by the mercury vapour lamp. In the writer’s experience, failures with the tungsten lamp have been turned into successes with the mercury vapour lamp. A third degree erythema is necessary in almost all cases, except in the acute stage, or when the skin is weeping; then, in the writer’s opinion, a second degree erythema may be used for a few treatments, until the extreme irritation is over. The latter, which is so often found in chronic cases, and which is so distressing, is allayed after two or three treatments.



*Cases.*—The following cases will show what can be done :  
 —Miss D., aged 26, came to the writer with the worst attack of the weeping variety of eczema that it has ever been his experience to witness. When first seen, this girl appeared to be quite sixty years of age ; it is impossible to describe the havoc it had made with her face, which was swollen to twice its usual size, and weeping profusely. Her neck, chest, abdomen, thighs, and legs, were in a terrible condition, and this, on and off, had been the case for years, gradually getting worse, till her life was a misery. Treatment was started with a general bath with the mercury vapour lamp, four minutes back and front. This treatment was followed systematically every forty-eight hours, until she had had twenty-two treatments, when she returned home without a trace of irritation, and with what was a remarkable feature—a lovely complexion. The old woman of sixty was turned into a healthy and vigorous girl of twenty-six.

To be sure that every spot was treated, it took the nurse over an hour to go over her body at each exposure, as the eczema was close up to the eyes, mouth, armpits, etc., all of which had to have the most careful attention, in order to have good results. The cure started with the first treatment, and steadily progressed. Before she came under the writer's care she had tried everything, until she had despaired of ever being cured. After many months, she reports that she is "still as well as ever, without a blemish upon me anywhere," and later still her sister reported that "she now has a lovely complexion and is quite well."

Mrs. B., aged 30, a married woman, with one child 1½ years old, was sent to the writer by her doctor on October 28, 1925, to see if anything could be done for her. The history of the case is as follows : Some ten months previously she developed eczema practically all over her body ; the face in this case was free, but otherwise she was more or less covered back and front with an intensely

irritating rash, which she had scratched until she was a mass of bleeding spots. She stated that this irritation, whilst always more or less continuous, became much worse during the night when warm in bed, so much so, that she hardly ever had more than an hour or so of continuous sleep. The flexor aspects—armpits, elbow joints, knee joints, etc.—were the worst, but the body generally was covered with the rash. Treatment was started at once with the mercury vapour lamp, giving three minutes all over and taking each part separately. This was increased gradually until she was getting twelve to fifteen minutes, special attention being given to every point so that no inflamed spot escaped. A third degree erythema was always administered. As she lived some distance away in the country she could only come up for treatment once a week, though occasionally it was given twice a week, but this was not often. During the treatment she was put on ½ grain doses of thyroid twice daily, and the following :

Permanganate potassii..	..	..	gr. ⅛.
Aq. distillata ..	..	..	oz. 10.

*Sig.*—To be injected very slowly per rectum, half an hour after a motion, and retained.

*Permanganate of Potassium Treatment.*—This was a treatment suggested by Dr. Nott in the *British Medical Journal* of December 26, 1925, and one of which the writer can speak highly in these cases. It is generally used for high blood pressure. In giving the permanganate of potassium great care must be taken to ensure that supplies are fresh and quite pure, otherwise the good effect is lost. This would appear to be a simple matter, but in reality it is most difficult to make chemists realise the necessity of having it pure and fresh. Only a small supply at a time should be bought in order to ensure this. (See Dr. Nott's report in the *British Medical Journal* of December 26, 1925.) After about



eighteen treatments all the eczema had completely disappeared, but the irritation remained, and the question arose as to how to allay this, as ultra-violet did not seem to do so.

*Colour.*—Being a great believer in the colour treatment, it occurred to the writer to try the effect that "blue" would have upon it. It was so successful, that after three or four exposures of fifteen minutes, repeated weekly, it all disappeared. A few weeks ago (May, 1927) the patient stated that she was "quite free from all trouble." This woman came to me as incurable, a statement made to her by two London skin specialists. It shows what can be done with this ray.

It has been suggested by several writers that the ultra-violet ray should not be given in the acute and weeping stages of eczema, but mild lotions applied until all inflammatory action has disappeared. The writer entirely disagrees with this view; he has had many cases in this stage, and the ray has given every satisfaction.

*Mrs. E.* came for treatment for acute eczema on December 31, 1926. There was profuse weeping over the right frontal region and cheek, left side of neck and inner side of both thighs, and flexor surfaces of forearms. The irritation was especially bad when warm in bed; so much so, that she had torn herself to pieces, and there were many bleeding spots over the affected area. She was given a second degree erythema over all bad surfaces, and a first degree over the rest of the body, with the mercury vapour lamp. The next day all the spots had dried up and the irritation was gone. The treatment has completely cured her. One could quote many more cases, possibly not so severe, but with just as good results. However, it is not necessary.

It should be remembered that all crusts and scales should be removed before starting the treatment. It has been found that damping the parts with salt and water (1 drachm to the pint) adds to the cure; why it does so is difficult to

say. Epsom salts also may be used. Another important point to observe is, that as the mercury vapour lamp is a comparatively cold lamp, some other heating arrangement must be made. The author always uses a radiant heat lamp of 1,500 to 2,000 candle-power with the mercury vapour lamp, suspended from the ceiling, and so arranged that the heat is thrown upon the patient's body and can be kept up to the desired amount. It should be remembered that flushing of the skin capillaries is to be avoided during the treatment of eczema; therefore keep radiant lamp some way off patient.

#### ALOPECIA

Of all skin diseases, this one has been claimed by the ultra-violet ray enthusiasts as the best for results, particularly the Areata variety; but the writer does not altogether agree, as there are several other skin diseases, which, if properly treated, to his mind, give as good, and even better results.

#### **The Seborrhœic Variety or Premature Baldness.**—

The gradual thinning of the hair, which is so much more common in young males than in the opposite sex, does not give such good results as the Areata variety. If this disease is left alone, it will gradually spread all over the head. In slight cases treatment is easy, but in the progressive form it requires more vigorous methods, and it is here that ultra-violet radiation comes in. Give a good local treatment wherever there are patches of baldness, going to the third or fourth degree of erythema. One must remember that on the head it will take a longer exposure to obtain this result. Exposures are repeated when the reaction is fading, and when the hair begins to grow, it will require repeated clippings. On an average, treatment should be given twice weekly and should be kept up for some months. If after several weeks of treatment, the scalp shows no improvement, the prognosis is bad.



**The Areata Variety.**—This, as a rule, is the most satisfactory of the two, and better results are obtained, but it is no use unless a third degree erythema is produced, and each treatment followed by scalp massage. The writer has had the best results with this combination. Care should be taken to cover up the unaffected parts, such as the ears, neck and face, for one should remember that the exposures are of long duration, and the lamp possibly within a foot or less of the patient, so that these parts, if exposed, would get badly burnt.

Alopecia caused by destruction of hair follicles due to wounds, does not respond to radiation.

#### HERPES

**Herpes (Zoster, Genitalis, and Facialis).**—All these conditions can be benefited by ultra-violet radiation. The duration of the illness, if taken in the acute stage, can be shortened, and pain reduced to a minimum. Good results are obtained with the mercury vapour or tungsten arc. The worst case under the writer's care was treated from first to last with the tungsten arc. If the case comes for treatment when vesicles are out, the mercury vapour lamp will dry them up and relieve all pain. Give a general bath first, then apply the ray over the vesicles; as soon as the erythema has subsided, give another, and, if in the acute stage, six to eight treatments should suffice. It is claimed that no neuralgic pain remains after the disappearance of vesicles. This after-pain, especially in old people, is one of the most difficult symptoms to overcome, when treated by the ordinary methods.

The following was a very bad case:—*Mr. J. H.* came for treatment on February 6, 1925, suffering from violent pain in the intercostal space corresponding to sixth and seventh thoracic intercostal ribs, left side.

**History.**—In March 1924, he suffered from a bad attack of shingles, which left him with severe pain along the course of these nerves. The pain was worst over a spot the size of a crown piece, corresponding to the terminal of the nerves on the left side. Everything had been done to give ease, with X-ray, medicines, ointments, etc., but to no effect. He rarely had a night's sleep, and during the day the pain was still very bad. When the writer saw him, treatment was started at once. After three weeks, with three treatments a week, he stated that he felt much better, and was getting intervals of ease which he had not had before. At each treatment he had had the general bath, and local application with the tungsten arc, given so that the third degree erythema was obtained. The treatment was continued till fifteen to twenty applications had been given, when he stated that he rarely had the pain unless he was over-tired, when it returned slightly. On September 26, 1926, the writer heard that he was quite well, and had been so since discharged. This case was an extremely bad one, and, as stated, every means had failed until ultra-violet radiation was tried.

Mercury vapour baths, with tungsten arc locally given to the third degree erythema, are best over the most painful spot, and the course of nerve from spine to terminal should be rayed. It should be given every second day, and followed up until ease is obtained. This treatment rarely fails to cure.

#### ACNE VULGARIS

The essence of this disease is the plugging of the mouths of the sebaceous follicles by a comedo, familiarly known as a "blackhead." Is there anything so repulsive on a face, that otherwise might be good-looking, completely spoilt with bad acne? We read that the disease is practically confined to the period of adolescence, being most common between the ages of 16 and 20. After 30 it is rare, so rare that the appearance of a disease simulating acne, after that age, should always



lead to a careful inquiry as to whether the patient has been taking some drug, such as bromides or iodides. The ordinary treatment of the present day is with vaccines, medicines, soaps and ointments, but how frequently do we find that these have no effect, or perhaps only for a short period, when the whole disease returns with renewed force! Acne responds most favourably to ultra-violet radiation even in the most obstinate cases. Although in some cases a marked improvement seems to result from the first treatment, this is not the invariable rule; most of the cases in the writer's practice have shown no improvement until the fifth or sixth treatment. If an improvement is to be aimed at, the disease must be attacked vigorously from the first. Tell the patients that they will probably have to remain at home for a few days, especially if the disease is on the face. Desquamation must be brought about, following a third or fourth degree erythema; nothing short of this will do any good. The writer's first cases were failures, simply because he hesitated to adopt this method.

The improvement which results is probably due to:

(1) The shedding of the unhealthy skin, and new healthy skin being formed, (2) the stimulation of the sebaceous glands and the flaccid muscles. But unless the general bath is given as well, to tone up the entire system, the best results will not be attained.

For the ordinary acne vulgaris, ten to twelve treatments should be sufficient; the chest and back often respond better than the face, and this is possibly because a more heroic treatment is started from the first. It is essential that the patient should keep in as good a state of health as possible. Prescribe plenty of open-air exercise and plain food, and specially instruct the patient to avoid all diet of a greasy nature.

These cases are nearly always attended with constipation, especially in women; the ray will help this condition some-

what, but is rarely sufficient without the aid of some drug like cascara sagrada, or possibly better still, electrical treatment, faradic or sinusoidal, to tone up the muscles of the abdomen and large bowel. All soaps, ointments, or anything of a greasy nature should be removed before the ultra-violet ray is applied, and if the pustules are full of pus, it will aid the cure if these are opened and evacuated. The texture of the skin will soon show an improvement if the treatment is carried out in a systematic manner; it will become healthy and velvety in character, and the patient's whole system will improve with the disappearance of the disease. A mercury vapour lamp should be used, and it is important to obtain a third degree erythema. Where there are pustules, the mercury vapour lamp is practically essential, as the long rays are not nearly so effective. Some authorities prefer the X-ray treatment for this disease, but the writer considers that ultra-violet ray should always be given a preference, and the X-ray used only when this method has failed. In deep and indurated cases with a tendency to early recurrence, the X-ray may be indicated.

#### SEBORRHŒA

**Seborrhœa** is a disease in which there is great scope for clinical application of the ultra-violet ray. To estimate its exact value in seborrhœa, one must have a clear understanding of the pathogenesis of this disease.

A well-known authority states that: "Seborrhœa is a metabolic condition, controlled by endocrinous, digestive, and diabetic factors. The bacterial element in seborrhœa is due to a secondary invasion of the bacillus seborrhœa and staphylococci. This being the case, it is clear that ultra-violet radiation can be helpful in seborrhœa only partially, by clearing up the acne lesions through its bactericidal, stimulating, and superficially keratolytic action." In giving



the ultra-violet ray, it should be followed out to the second or third degree, not less than twice a week. All hairs should be shortened as much as possible, and all grease or scales, if present, removed first.

Bathing the part with a warm solution of Epsom salts, or saline solution, is an excellent method. The mercury vapour lamp should be used in preference to any other, and the patient not allowed to cease treatment, until the doctor is certain that every infected area has been treated.

#### LICHEN PLANUS

In **Lichen Planus** the writer finds that ultra-violet radiation is extremely useful because of its antipruritic effect, and even more so on account of its beneficial systemic effect. This disease is admittedly a skin manifestation of nervous, generally debilitated, or toxæmic origin, and the general tonic effect or vitalizing action of ultra-violet ray, is of direct value. Mild application of a general bath twice or three times a week, followed by the appropriate local application, is sufficient.

#### ICHTHYOSIS

**Ichthyosis** is fortunately rare in its severer form, but is very often met with in its milder state. The mildest form goes by the name of Xeroderma (dry skin), is generally the result of colder weather, and is usually in certain situations—the knees, elbows, and axillary borders. The writer has had several cases of this, which were soon cured by the mercury vapour lamp. It is not necessary to give a third degree dose; a first or second is quite sufficient, and six treatments should cure this class of case. We have a totally different case to deal with in the severer form. The writer has never met with it, therefore cannot say how long it would take to cure, but a third degree erythema would be necessary.

#### IMPETIGO

Excellent results are obtained with ultra-violet radiation in this disease. Before proceeding with treatment, there are certain requirements necessary for a good result. All crusts and discharges should be removed with starch poultices or oil; it is quite useless to give the radiation unless this practice is strictly followed out, not only in this disease but in all cases in which there is a discharge, or where crusts have formed, otherwise the radiation does not penetrate to the affected part. A third degree erythema is necessary with the mercury vapour lamp, for the bactericidal effect, and for the increase of lymph to the parts. When the reaction is beginning to fade, the exposure is repeated about the third or fourth day, according to the severity. Keep on with the treatment till all signs of the disease have passed away. A good course to pursue is to give treatment every second or third day till the disease subsides. Allow a week to elapse before giving another, and repeat this; then wait for a fortnight, and if the disease shows no sign of return, the case may be considered cured.

#### KELOID

**True Keloid** must be distinguished from the hypertrophic scar. The former is a characteristic growth, probably having its origin in small scales of a very minute nature. The keloid often commences in a scar produced by the application of a mustard poultice. Radiation for a third degree erythema is required for these cases, with either the mercury vapour lamp, or the tungsten arc. As soon as the reaction has faded, repeat the dose. The length of treatment required, depends upon the severity of the keloid.

#### NEW GROWTH

**Moles (Nævi).**—These can be treated very satisfactorily with ultra-violet radiation. Long before this ray came



into general use, these were treated with carbon dioxide snow, and diathermy cauterisation. Ultra-violet radiation has two great advantages over the old methods; it is practically painless, and is not apt to leave the nasty scar that cauterisation and carbon dioxide snow sometimes do.

*Firstly*, care should be taken that the surrounding skin is protected with either lead-foil, adhesive plaster, or chamois leather, etc.

*Secondly*, a water-cooled lamp is required, the quartz being firmly pressed against the lesion.

*Thirdly*, blistering must be produced, otherwise there will be no result. Treatment should only be recommended when the condition has quietened down.

**Capillary Nævus** (or, as they are generally called, port-wine stains) can also be treated successfully with ultra-violet radiation. Electrolysis, X-ray, radium, carbon dioxide snow, have all been used more or less successfully, but to get good results, it requires skilful treatment, and it is by no means as simple an operation as some surgeons think. The dilated vessels being in the skin itself, it is not easy to occlude them without doing the skin harm; therefore, since the introduction of the ultra-violet rays, this method has become more popular.

The caution and advice given concerning Nævi, hold good with port-wine stain, except that if the area of the lesion is large, it should be mapped out into sections, and the lamp applied to each in turn, either at one sitting which greatly shortens the operation, or taken separately piece by piece. Treatment should not be reapplied until all inflammatory mischief has died down, which usually varies from fourteen to twenty-one days. After each treatment, there should be a diminution of coloration.

### TELANGIECTASIS

These cases are very frequent after X-ray treatment, and until the advent of ultra-violet ray, very little, if anything, could be done to them. A fourth degree erythema is necessary, leading to the obliteration of the vessels. Water-cooled lamps are again the best for these cases (although with the air-cooled some have claimed good results), using the quartz compressor as described in nævi treatment. The dilated blood vessels should gradually disappear leaving a faint scar.

### SIMPLE BURNS

It has been shown that remarkable results may be obtained with ultra-violet ray upon burns. If any treatment should have been revised long ago, it is the treatment of burns.

The old method may be abandoned, of applying oil, ointments, picric acid, flour and water, with the great pain and discomfort to the suffering patient of tearing off the dressings day after day.

Burns of all kinds heal quickly to light, practically all burns are sterile, and the heat that destroys tissues also sterilises them. The great difficulty is to keep them sterile. How is the physician to do this? The answer is with light therapy.

Infection of burns must occur from bacteria introduced from without; from adjacent unburnt skin, clothing, dressings, air, and many other ways.

In treating with the ultra-violet ray and light, no dressings are required; it is the best germicide we have and the easiest to apply. It can be applied without touching the patient, without pain, and without instruments or dressings coming into contact with the wounds. The patient is kept constantly, night and day, under the light, but it must not be supposed from this that it is the ultra-violet ray lamp;



the light from an electric light bath is kept going day and night, but the ultra-violet ray is only given once daily for three minutes, at 36 inches distance, with the mercury vapour lamp.

**Electric Light Cabinet.**—The best method is to put the patient into an electric light-bath cabinet, taking care that the heat is not too intense. In this way, nearly the whole body is exposed to the light at once. The patient should wear as little clothing as possible, and all burnt parts should be constantly exposed to the light, which should never be turned off, night or day, until the patient is cured. This will be in an astonishingly short time, as compared with the old method of treatment.

If this treatment is followed out systematically, it will be found that the temperature keeps normal, there will be absence of pain, no suppression of urine, and no dressings required. Blisters should not be opened, but allowed to dry up, and scabs should not be pulled off, but allowed to fall off of their own accord. Scarring will be absent.

**Deep Therapy Lamp.**—If the burn is not very extensive, the light from a deep therapy lamp may be used, provided it plays on the wound day and night, and is not too near to cause extensive heat. Healing may be expected from the twelfth to fifteenth day; that under the old method naturally takes months.

Light therapy with a suitable amount of ultra-violet radiation daily, is, par excellence, the best for these cases. It will be found that—

- (1) It relieves pain ;
- (2) Requires no dressings ;
- (3) Keeps down infection ;
- (4) Eliminates scars and contractures ;
- (5) Is a wonderful tonic ;
- (6) Accelerates elimination.

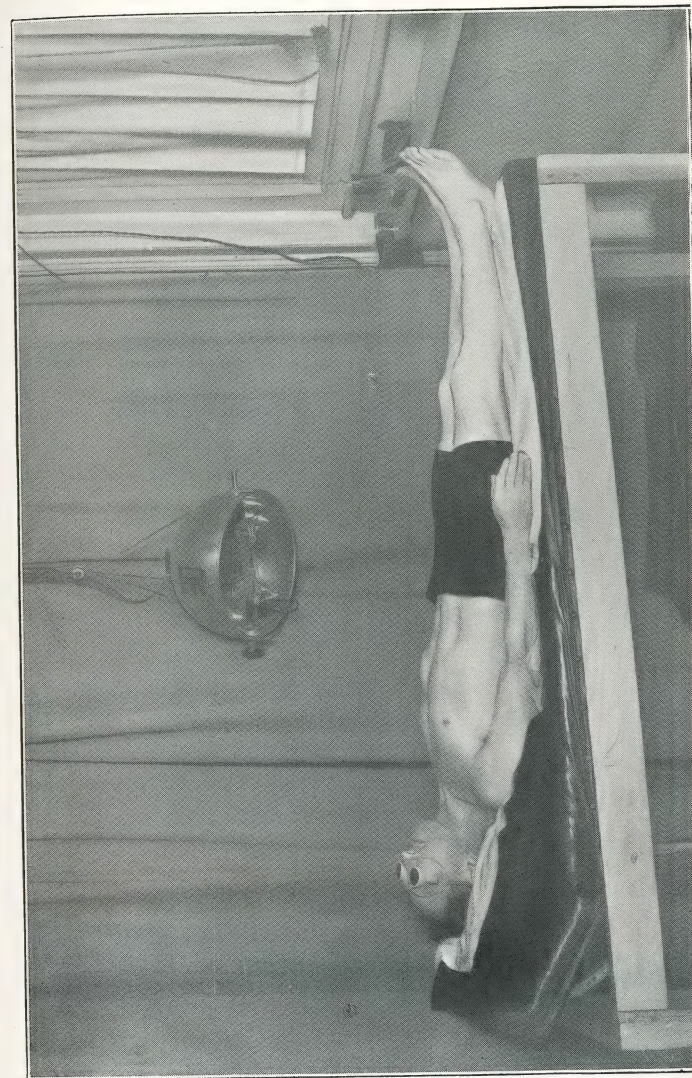


FIG. 36.—General Irradiation with Mercury Vapour Lamp.

[To face p. 104.]



## CHAPTER XIII

### TUBERCULOSIS AND LUPUS

Open air—Rollier's treatment—Prof. Finsen : Lupus—What lamp to use—Tuberculosis, dermatitis, and ulceration—Tubercular glands—Bones and joints—Tubercular peritonitis—Phthisis.

THESE two diseases must be taken together, and deserve a chapter to themselves. There is possibly no disease (except perhaps cancer) that has called forth more energy on the part of the medical profession, than tuberculosis—with doubtful results as yet.

**Open Air.**—Open air and sunlight have become the great treatment for this disease. Vaccines, injections, and scores of other treatments have been devised, but they have all had to revert to fresh air and sunlight ; undoubtedly the latter, with certain vaccines, will give the best results. Whether ultra-violet be given by the sun or by artificial means, great caution should be exercised at first, until the patient is thoroughly acclimatised to it. In this country, natural sunlight is a difficult proposition, because our climate is so variable in character. How often do we have a beautiful day, with the sun pouring down, unaccompanied by cold winds ? It has been truly said that only in the months of July and August is it suitable for giving open-air treatment, and often not even then ! So that we have to rely almost entirely upon artificial sunlight with carbon, tungsten, or mercury vapour lamps.

For sunlight treatment, we must send our tuberculous patients to the High Alps ; unfortunately, this is within the



reach of only a few of the thousands who suffer from tuberculosis. A certain number of people go to the drier and warmer climate of Egypt and the desert.

**Rollier's Treatment.**—For a number of years now, Rollier has been achieving marvellous results in tuberculosis of the bones and gland affections, at Leysin; in England, under the care of Sir Henry Gauvain at Alton and Hayling Island, similar results are obtained. Whereas in the Leysin district they never have to resort to the artificial lamp, they have to rely upon it only too often at Alton and Hayling Island.

**Finsen's Treatment.**—Prof. Finsen, the pioneer of the light treatment, is so well known to the world that it is superfluous to say anything about him and his great work. There are very few of his lamps in London at the present day; the London Hospital has one, which is very rarely used, and is more of a curiosity than anything else. It takes up too much space, and is too costly to run. There are now so many lamps on the market that answer the same purpose.

Lupus was the first condition treated by Prof. Finsen, with the carbon lamp, and with most excellent results.

There are many varieties of lupus; catarrhal, fibroid, warty, and lupus vulgaris simplex. As they all have the same origin, the tubercle bacillus, it will be found that the ultra-violet ray gives the best results. The latter should be tried in preference to the X-ray; the former is much less dangerous, and if the reaction is excessive, there is usually rapid healing, with no scar formation. In giving this treatment, it should be carried to the fourth degree; the best method is with a quartz compressor, pressing it well down upon the part, so as to ensure the maximum amount of ray, and to prevent it passing into the blood. The reaction (fourth degree) should be such that the diseased tissue is destroyed, and healthy tissue promoted. If there is a large amount of soft boggy tissue, a good plan is to remove it with

a sharp spoon, and allow it to settle down for a few days, before giving the ultra-violet ray exposure; in this way, the healing is hastened. General radiation of the whole body should be carried on at the same time as the local radiation, in order to keep the tone of the patient's system up to the highest mark. Also impress upon the patient that plenty of nourishing food is required.

*What Lamp to Use.*—For the general treatment, carbon and tungsten mixed is very good. The lamp which the writer uses for combining this method is very handy; the carbon lamp is turned on for as long as is necessary, switching on the tungsten electrode for the last five or ten minutes, or if preferred, using the metallium electrode. It is found that the tungsten, as supplied, is too variable in its output, whereas with the other metal, a constant flow of ultra-violet for ten or fifteen minutes can be obtained, without any intermission of the ultra-violet. From the experiments made in the writer's own treatment room, there is no comparison between the tungsten and metallium in output of ultra-violet ray. By using the general as well as the local treatment, they have found at the London Hospital that the combination of the two gives an increased cure of sixty to ninety per cent.

**Tuberculous Dermatitis and Ulcerations** heal very rapidly with ultra-violet radiation; it is not necessary here to carry it to the fourth degree; the second or third degree is enough, but the writer would give a general warning to those who are new to this work; the surrounding healthy skin should always be well protected, otherwise there will be serious trouble, and as a new skin is formed on the ulcer it, too, should be protected. Do not be too eager to follow with another treatment before the last has completely faded.

For local work, some prefer the Kromayer lamp, others the tungsten, but if one may say so, it matters very little



what style of lamp is used, so long as the general and local dose is given.

**Tuberculous Glands.**—If possible, start the treatment before the formation of pus. If the latter has formed, it does not prohibit the use of the ray, but first open and let out the pus, then start the treatment straight away, and the results will be good. Use the carbon-mercury vapour lamp in preference to the tungsten, or if the gland contains pus use the mercury vapour lamp, as it gives a preponderance of short waves, and it has been found that the bacilli are overcome more quickly by the shorter waves than by the longer ones. Here again, use general and local treatment, and instruct the patient to attend to general hygiene.

**Bones and Joints.**—It is in this class of tuberculous lesion that Rollier has found such benefit in ultra-violet radiation. Although in very different surroundings at Alton, Gauvain also has had excellent results. Astounding results are achieved in old ankylosed joints, and good movement obtained in joints that look as if they would never move again.

Although we have not the same climatic conditions here, it is not necessary to go all the way to the Alps to obtain good results, but with the sunlight carbon or mercury vapour lamp, or metalium, used both locally and generally, there are few cases that cannot in time be cured or greatly improved. The difficulty is to persuade patients that it takes time; they expect to achieve in weeks that which takes months to attain. It also must be impressed on them that attention must be given to hygiene, and the system built up with good nourishing food. All deformities should be corrected with orthopaedic methods. Sometimes good results are obtained with the X-ray and ultra-violet ray in combination.

**Tubercular Peritonitis.**—In these cases great benefit results with ultra-violet radiation, the abdominal fluid gradually becoming absorbed, and the patient's weight and health

improving. The writer remembers a patient, who in 1919 had had an operation, when tubercular peritonitis was found. The whole of the small intestines and peritoneum were a mass of miliary tuberculosis, with an enormous amount of fluid. He was given ultra-violet rays, general and local. In a very short time the fluid began to disappear, his general health picked up, and within the year he was practically well, and has kept so ever since.

**Phthisis.**—For a long time those working in ultra-violet ray refrained from treating lung-tuberculosis, as in the few cases that had been treated, the results were anything but good. Possibly this fallacy, that bad results were always obtained in these cases, was chiefly due to not knowing which cases to treat and which to leave alone.

**Hæmorrhage.**—All cases with a general tendency to hæmorrhage should be left alone, or very cautiously dealt with. The pulse should always be taken before and after treatment. Patients who have had no hæmorrhage, or those with few clinical signs, or with but small spaces of the lung attacked, will undoubtedly derive great benefit from this ray, but even in these cases, great caution should be exercised, and only small doses given. A case was reported in the *British Medical Journal*, in which the tubercular bacilli were found to decrease greatly after radiation, and the general tone of the patient improved.

Those who are anxious to try it, should give the ultra-violet ray very cautiously at first, watching the patient for unfavourable symptoms, and stopping immediately if any arise. Give the local and general treatment, using tungsten or carbon arc, or both together.



## CAPTER XIV

### DISORDERS OF NUTRITION

Rickets : laboratory experiments : experiments on food : Photographic : When treatment should be commenced. Rheumatism, acute and chronic : Fibrositis : Lumbago and the Arthritic group—The ray to employ—Combination of treatment. Sciatica—Neuritis—Tic Douloureux—Neuralgia—Chorea—Paralysis Agitans—Neurasthenia—Anterior Poliomyelitis.

#### RICKETS

It has become an established fact that ultra-violet ray is a specific for rickets. This disease is rarely seen now, except in the poorer quarters of towns, where bad food, ventilation, and loss of sunshine, all help to bring it about. It has been called by Dr. T. A. Palm, a "disease of darkness."

**Laboratory Experiments.**—Numerous experiments have taken place in scientific laboratories upon rats, etc., which tend to prove that if the rat is fed on a vitamin-free diet, and kept in darkness, it will die ; but if fed upon the same diet, and given ultra-violet radiation daily, it will not develop rickets. It has also been proved that if a rat is fed upon a diet of margarine and pure white bread, it gets thinner and thinner, and eventually dies. Subject the same diet to ultra-violet radiation for half an hour daily and the rat puts on weight and recovers. This is due to the increase of phosphorus and calcium in the blood by the ultra-violet radiation.

Dr. S. J. Cowell was able to demonstrate the same fact in children suffering from rickets. They were given milk

### DISORDERS OF NUTRITION

III

which had been exposed in shallow dishes daily to ultra-violet rays, some three or four feet distant from the lamp. One set of cases were fed on the irradiated milk diet, the other on the normal diet ; the irradiated milk cases showed a marked improvement in calcification.

**Experiments on Food.**—All the experiments on food exposed to ultra-violet ray, in connection with animals or human beings, result in proving what a wonderful vitaliser ultra-violet radiation is. It is at last becoming a recognised practice to have ultra-violet lamps in all hospitals, so that the poorer classes, who cannot pay for this treatment, may have the facilities free.

General irradiation in all cases of rickets, should be carried on for many months, starting with a few minutes daily, or on alternate days, and working up until the child is getting half to three-quarters of an hour at a sitting. At all the clinics, lamps are so arranged that the children can play whilst getting the rays.

**X-ray Plates.**—In rickets, photographic X-ray plates should be taken before and after treatment ; these will show a marked difference. The characteristic enlargement round the epiphyses disappears ; the epiphyses become clearly defined, and calcium salts are deposited in the shafts of the long bones. Every child in the poorer quarters of towns should be made to undergo ultra-violet irradiation at one of the hospitals or clinics ; even if no sign of rickets is present, the effect of the rays on the general welfare of the child, would compensate in better health, and help to avert the possibility of tubercle forming later in life.

**When Treatment should be Commenced.**—If treatment is commenced early, the malformation of bones can be averted, and also that terrible deformity in the long bones of the tibia and fibula so often seen in the children of the poor, and for which the only procedure is osteotomy. Ultra-violet radiation in rickets, has got beyond the experimental



stage, and has long been looked upon as specific in this disease.

#### RHEUMATISM

**Rheumatism : Acute and Sub-Acute, Rheumatic Fever, Fibrositis, Muscular Rheumatism, Lumbago, and the Rheumatic Arthritis Group, etc.**—Of all the diseases we are asked to treat, by far the most fall within the above group ; they can be classed together, because the treatment for one is the treatment for all.

**The Ray to Employ.**—The first question to be considered, is what ray to employ. The writer of a recent book on ultra-violet radiation, treated every disease alike, *i.e.* with the same lamp, and therefore with the same wavelength. If there is no difference in the tungsten arc, carbon, metallium, and the many mercury vapour lamps on the market, why trouble to have so many ? Those who have studied this subject with the spectroscope, will see that the output of all these lamps varies enormously. (See chapter on electrodes, etc.) Some are very rich indeed in the long waves, and others in the short waves, but all, more or less, have both. Our object, however, is to obtain a lamp that is rich either in the long wave, such as the tungsten arc, or in the short wave, such as the mercury vapour variety. We then have to decide which wave is suitable for each of the many diseases we are daily called upon to treat. Most of those who have a considerable experience in ultra-violet radiation, have come to the conclusion that the long radiations are undoubtedly the best for rheumatism of every variety, for diseases that possibly have their origin in rheumatism, *e.g.* neuritis, and perhaps for some forms of gout. Sub-acute cases, or those of recent origin, respond more readily, of course, than chronic cases, but even in chronic rheumatoid cases, a considerable alleviation may be looked for.

**Combination of Treatment.**—It must be borne in mind that there is a good proportion of cases in which no result

can be expected, unless the treatment is combined with other methods, such as vaccines or medicinal treatment, and we have to try to differentiate between them. After thorough examination, it is as well to tell patients candidly what results may be expected, in order to save them possible disappointment.

Both local and general irradiation should be given ; a third degree exposure gives by far the best results, being repeated every second or third day, according to the fading or otherwise of the erythema. Perhaps the few following cases will illustrate the good results that can be obtained :—

**Cases.**—*Dr. S.* came to the writer, suffering from fibrositis more or less all over.

**History.**—He had had several attacks, which had left him extremely stiff in all the muscles of the back and legs ; so much so, that he found difficulty in walking far without great fatigue, and also had some difficulty in stooping and raising himself. He had tried most treatments, vaccines, etc., with very little benefit. On December 18, 1924, he commenced treatment with ultra-violet ray. He was given general tungsten arc irradiation, beginning with three minutes anterior and posterior, and local treatment over the worst spots. On December 18, 1924, his blood count was as follows : Red corpuscles, 5,500,000 ; H.B. 96 per cent. ; Colour index, 0·85 ; Leucocytes, 3,700. After six weeks' treatment, the examination showed : Red corp. 5,800,000 ; H.B. 98 per cent. ; Colour index, 0·86 ; Leucocytes, 5,000 ; and he had put on 13 lbs. in weight. On March 4, 1925, his blood count was : Red corp. 6,000,000 ; H.B. 106 per cent. ; Colour index, 0·88, and Leucocytes, 8,400.

During this time he was making rapid progress ; the feeling of malaise and stiffness of muscles were disappearing, and he was feeling greatly improved generally. During the three months of treatment, he put on between thirteen and fourteen pounds in weight, and was looking so well that his



friends hardly recognised him. This case completely recovered.

To illustrate a different class of case: *Miss N.* came to the writer suffering from acute rheumatism in the right knee, which contained fluid and was very swollen.

*History.*—The trouble was of fairly long standing; she had consulted many doctors, with minor results, and eventually was told that nothing further could be done for her. She was unable to walk up or down stairs, except with great difficulty.

After thirty treatments of general and local radiation with massage, the fluid in the knee had quite disappeared, the pain in the joints had subsided, and she was eventually able to go up or down stairs with ease. Last Easter, when staying with her brother-in-law—a doctor, who had previously told her that nothing could be done for her—she out-walked him in a five-mile walk, and during the general strike she bicycled to and from her business each morning. When on her summer holiday in Devonshire, she indulged in six and seven-mile walks with ease.

Yet another different type of case:

*Captain G.*, suffering acutely from lumbago, had been treated by his own doctor without success, and it was with great difficulty that he managed to reach my treatment rooms. He received general radiation, and with the tungsten arc lamp was given local radiation to the lumbar muscles. He was put on a course of twelve treatments, in order to remove the poison thoroughly out of his system. When he came for the second time, he reported that two hours after the first treatment, he felt so much better, and free of pain, that he actually could have played tennis!

Such rapid results are not usually achieved, and although the writer has had several nearly as rapid in acute cases, it is not advisable to tell patients they will be cured so quickly, or they may be disappointed if they do not have similar results.

To sum up: good, and in some cases, remarkable results may be expected in nearly all rheumatic cases, if the treatment is carried out in a proper manner, and a good erythema obtained. We cannot go as far as to say that if only a first or second erythema is brought about, results will not be so good, but they will be certainly much slower. Massage of the joints, with manipulation and movements, greatly facilitate the cure. It has been found that better results are obtained with tungsten or metallium than with the mercury vapour lamp. Naturally, this can only be expected, when it is the long wave-length that cures best, whereas the mercury vapour variety of lamp is richest in the short waves.

#### DISEASES OF THE NERVOUS SYSTEM

**Sciatica.**—Results following the application of ultra-violet radiation depend on the cause; if due to pressure upon the nerve, no good can be expected, but if due to infection or cold, good results nearly always follow. Give general treatment, with local treatment along the course of the nerve. It will be of no use unless a third degree erythema is produced, and as soon as this fades follow on with another dose. As a rule, two or three treatments a week can be safely given, but it will take from six to eight weeks to effect a cure, unless the trouble is of very recent origin. As in all these cases, the best ray to use is that of the tungsten or metallium arc with long waves; it can also be applied locally. The writer finds that an excellent method is to give ionisation with soda salicylate once a week, and the ultra-violet ray twice a week.

**Neuritis.**—Great benefit can be obtained from ultra-violet ray as in sciatica. In these cases give general and local treatment with the long-wave lamps (tungsten or metallium), and with ionisation as in sciatica. A third degree erythema must be obtained.



**Tic Douloureux.**—This is one of the most painful conditions, and anything to effect a cure is worth trying. As long as there is no pressure on the nerve as it issues from the bony canal, there is every reason to hope for a cure, or for great relief. General treatment followed by local over the affected side of the face, and also over the cervical spine, every forty-eight hours, should be sufficient.

**Neuralgia.**—Here again general and local treatment as a rule procures relief, sometimes remarkably quickly.

**Chorea,** due to shock or rheumatism, should be greatly benefited by ultra-violet radiation. General baths have been known to have a wonderfully soothing effect upon some patients, and induce sleep where everything except narcotics has failed. Torticollis and incontinence of urine are both improved.

**Paralysis Agitans.**—Good results with ultra-violet radiation have been claimed by some authors in these cases. In early cases possibly some good will result, but in those of long standing it is difficult to see that much good will be effected.

**Neurasthenia.**—The writer has had a number of these cases, and they have all responded well. The treatment has a most soothing effect, and patients have been known to fall asleep while undergoing it. The radiant heat lamp applied for ten or fifteen minutes before commencing the ultra-violet treatment helps to soothe them, and also makes the skin moist. General treatment with the mercury vapour lamp, occasionally varied with the carbon, is as a rule sufficient.

**Anterior Poliomyelitis.**—For this condition ultra-violet radiation combined with electric treatment is the most satisfactory. General and local ray should be given, the former applied up and down the spine with the tungsten arc.

Either the tungsten or metallium arc, or the mercury

vapour gives good results; the writer has used both with benefit.

The earlier treatment is started the better, for it is a mistake to wait too long. This should be started as soon as the temperature goes down after an acute attack; generally speaking, about three to four weeks from the commencement of the attack.

*Case.*—The following case is of interest:

*Baby A.*, a mite of  $1\frac{1}{2}$  years of age, was brought for treatment, with a history of having contracted this disease some ten or eleven months previously. For nine months she had been having electrical treatment at one of the London hospitals, without effect. When treatment with the ultra-violet ray and electricity was started, she could not feel the latter and the muscles did not respond. However, after three months' treatment, the improvement was most satisfactory and the muscles responded to the electricity. She is now able to move the leg and is beginning to try to use it for walking, but it will be a considerable time before that can take place, as in these cases progress is extremely slow. She is still under treatment, so that it is too early yet to say what the ultimate results will be.



## CHAPTER XV

### DISORDERS OF THE RESPIRATORY SYSTEM

Whooping cough—Common cold—Asthma—Bronchitis—Chronic cough—Hay fever.

NEARLY all respiratory affections yield to the ultra-violet ray, as would be expected.

**Whooping Cough.**—Cases have been reported where the cough has almost entirely ceased after three or four treatments. The cases that have come under the writer's care have all done well, but one must not be too optimistic with regard to quick results. We cannot expect to cure a case of whooping cough under twelve to twenty treatments. The general treatment, with local over both lungs, should be resorted to in every case. First or second degree is sufficient, and for preference with the tungsten arc.

**Common colds** can be satisfactorily treated if taken in time. As soon as the sting or tickle in the nose is felt, give an inhalation dose of the tungsten arc. The patient should inhale the fumes that come from the tungsten points.

**System Adopted.**—The following is a system adopted by the writer, with most satisfactory results in all colds, bronchial, and asthmatical troubles. To carry out this treatment properly an apparatus is required, such as the writer uses for all local treatments, and which is described in the chapter on apparatus. All that is necessary is to move the ordinary reflector, replacing it with a curved reflector about 12 inches long, by 8 inches broad, fitted to the holder. The patient sits in front, with the head slightly bent towards the reflector, so that all the fumes coming

from the lamp can be inhaled. A sheet is thrown over the patient's head and the reflector, so that patient, reflector, and rays are all covered. As soon as the ray is turned on the patient is told to breathe in the fumes gently, first through the nose, and out through the mouth, and then reversing. In this way, the oxidised fumes emitted from the burnt tungsten are inhaled, and help to sooth the inflamed mucous membrane of the nose or respiratory organs. Five minutes should be allowed for this. Colds thus taken in time, have been aborted times without number by this method. If left for a day or so, such good results are not so possible, but the cold will undoubtedly be shortened.

**Asthma.**—Extremely good results have been obtained in this disease, and also in bronchial asthma. The best form of lamp to use is the tungsten arc, as this is one of the cases in which the long ray or wave seems to act more beneficially than the short one. The patient also gets the benefit of the fumes from the tungsten arc. The writer finds the following procedure the best for these cases: First give a general bath with the tungsten ray, then place the patient under the tungsten arc as described for a cold. Afterwards ray the chest all over with the tungsten arc lamp, so that a second degree erythema is obtained. If this method is carried out, excellent results will follow. The treatment should be given every second day for some weeks.

In bronchial asthma cases, just as good results can be had. The following will illustrate this:

*Case.*—*Mr. J.* came for treatment, suffering with a very bad attack of bronchial asthma.

*History.*—For some years he had been a martyr to the worst type of this trouble; his cough and asthmatical breathing were painful to hear, and the difficulty in walking, owing to the distressed breathing, was so bad that it was only after many stops that he managed to get down to the treatment room. All the usual treatments with vaccines had



been tried. The procedure as explained above was adopted, and it was soon apparent that he was receiving benefit. When his lungs were examined at the commencement of treatment, the apexes and bases of both were involved with the bronchial asthma. After a month's treatment, large tracts of lung were comparatively free; after twenty-five treatments, the lungs were sound from apex to base, the air entering freely and easily. Where he had previously been unable to walk twenty yards without stopping, he stated that he now went for a five-mile walk, and was able to enjoy his round of golf. The good effect has been more or less maintained, and though he states that he occasionally has slight attacks, they are nothing to what they were. No doubt the attacks could be warded off if he had a few baths periodically.

**Uncomplicated Bronchitis** is also amenable to ultra-violet ray, with or without inhalation. The general and local treatment over the lungs is generally sufficient, but if there is any tendency to asthma, add the inhalation.

**Chronic coughs** which defy all other remedies, will often yield to ultra-violet ray treatment better than to any medicinal remedy.

**Hay Fever.**—It is claimed that cures have been effected by the ultra-violet ray in this disease and, personally, the writer sees no reason why this should not be so, although with cases that have come under his care other methods have been adopted. The difficulty, of course, is to get the ultra-violet into the nares, anterior and posterior, and nasopharynx. This can be done with quartz pencils, or by using a small lamp invented by the writer for these cases. The general bath, as well as the usual method explained for treatment of a cold by inhalation, should both be employed. The great test of lasting results can only be seen when the nares are subject to the pollen of hay, or in some cases, to the pollen of certain flowers.

## CHAPTER XVI

### DISEASES OF THE NOSE, MOUTH AND THROAT

Tonsillitis — Stomatitis — Pharyngitis — Ozoena — Hypertrophied Turbinates: Atrophic Rhinitis: Serous affections—Vincent's Angina—Pyorrhoea Alveolaris.

**Tonsillitis: Acute and Chronic.**—Acute cases can be aborted in a few days. The rays should be played on the inflamed tonsil by the small tungsten arc lamp, as already described, or by the quartz pencil with the mercury vapour lamp. A fairly severe erythema dose should be given on the tonsils themselves, and over the tonsil area outside. In twelve hours relief will generally follow.

Chronic cases, with enlargement of tonsils, can derive great benefit, and in most cases shrinkage of tonsil. The following indicates what can be done for them:

*Case.*—In the winter of 1924, a youngster, six years of age, came under the writer's care for enlarged tonsils, the parents being very anxious to avoid an operation if possible. Upon examination, both tonsils were found to be greatly enlarged, and the boy apparently very run down. General baths were given, and local application with the small tungsten arc lamp on the tonsils themselves, as well as on the tonsil areas outside. A second degree erythema was given, and after ten treatments the tonsils were normal in size and the general health greatly improved. Over a year afterwards the mother stated that the tonsils had never enlarged again, and the



boy had wonderfully improved in health. The operation became unnecessary.

**Crypts.**—Where there are deep crypts which contain pus, these should be squeezed out by compressing the tonsil with one finger outside, and the other over the tonsil inside. This method requires some skill, but if properly employed the crypts can be completely emptied, and the ultra-violet applied as in the method described for enlarged tonsils. Permanently good results should be obtained.

**Stomatitis.**—This painful affection can be often greatly benefited with ultra-violet ray alone, or in combination with suitable vaccines or mouth-washes. However, one occasionally comes across a case in which good results cannot be claimed, as once occurred in the writer's practice. This case is mentioned because of its extreme rarity, and obstinate refusal to yield to all treatment.

**History.**—Miss B. came for treatment in 1924, with several large ulcers on tongue, lips, and gums. She stated that she had been to nearly every bacteriologist in London, and had had innumerable vaccines without result. The effect of these was all the same; they did good at first, and then the result seemed to wear off. The ulcers varied in size from a crown-piece to a threepenny-bit, and were most painful. They prevented her from eating anything but minced or soft broken-up food. To this complication was added ulcers of the same nature in the posterior portion of the vagina. These were exceedingly large, and need hardly be described as painful. For nine months, baths and local treatment with ultra-violet ray were given, with and without vaccines, with practically the same result—they healed up after a long time, only to break out again almost immediately, and each time ran the same course. Several bacteriologists examined the discharge, and all found staphylococcus and streptococcus. The ray seemed to do her good by helping to keep up her strength, and healing the ulcers quicker than when

she was not having it, but could not cure her. Her teeth were apparently good, and had been X-rayed. She was discharged finally as incurable.

Since then, she told the writer that she had been to one of the London hospitals, and had had her teeth X-rayed again, the doctor stating that her trouble might, or might not, be due to them, but he suggested that she should have them taken out, to which she agreed. This case is instructive in showing the extremely virulent type of stomatitis occasionally met with, and although ultra-violet ray could not be said to cure it, up to the present it is able to do more good than any other treatment.

**Pharyngitis.**—Here again great good can be done by the local application of ultra-violet radiation direct to the pharynx, care being taken to remove all pus or mucous before the ray is applied. A second degree erythema is required, direct to the part.

**Ozoena.**—Radiation gives good results in this exceedingly disagreeable disease. Care should be taken that all crusts are removed first, so that the ray can be applied direct to the affected parts. Either the tungsten arc lamp, as described for the tonsils, etc., should be used, or the mercury vapour with quartz rods, a third degree erythema being produced, from one to two minutes to start with, gradually increasing. It is impossible to say how many treatments may be required; this is in accordance with the severity of the disease.

**Hypertrophied Turbinates, Atrophic Rhinitis, and Serus Affections** have all been reported upon by different writers, who state that good results may be had with the ultra-violet rays, providing that the operator can direct the ray upon the affected part.

**Vincent's Angina.**—Denman reports good results with the actinic rays in these cases.

**Pyorrhoea Alveolaris.**—Several cases of this disease



have been treated by the writer with ultra-violet ray. Care should be taken to have the teeth X-rayed, in order to have the offending ones removed, otherwise not much result is likely. The hand lamp is specially adapted for this work, and with a little practice every part of the gums can be rayed. The gums can stand a good deal of the rays, but these cases are rather tedious as it takes some time to go all over the mouth, and unless care is taken results will not be effected.

## CHAPTER XVII

### DISORDERS OF THE ALIMENTARY SYSTEM

Hæmorrhoids—Dyspepsia : Gastric and Duodenal ulcers—Cirrhosis.

**Hæmorrhoids.**—Ultra-violet radiation has been used for the treatment of these. In internal piles the quartz rod must be used, otherwise it is impossible to focus the ultra-violet ray upon the pile. External piles, either chronic or in acute attacks, particularly where there is itching, undoubtedly derive great benefit ; the irritation is allayed, and patients state that they obtain great comfort. Where complicated with internal piles, the ray applied externally and with rods internally, combined with suppositories of anusol, gives great relief.

**Dyspepsia, Gastric Ulcers, and Duodenal Ulcers,** are all relieved by applying the ultra-violet ray with baths and locally over the stomach area with the tungsten arc. A third degree erythema must be obtained to have good results.

*Case.*—The case of *Miss M.*, who was under treatment in the autumn of 1924, will show what can be done.

*History.*—For a long time she had been having intense pain over the gastric area, coming on just after food and continuing for some time. There was great tenderness over the duodenum and pyloric area, with occasional vomiting. She had lost weight and strength, so that it was with great difficulty that she managed to come for the treatment. This was started in August, 1924, and continued with three treatments a week for three months. Owing to prostration,



general baths were given, with local treatment over the stomach area. After a month's treatment she was considerably improved, could eat a little, and was apparently digesting her food as her weight began to increase. Her nervous system was very bad at first; however, this improved slowly. After three months she left for the country, expressing herself highly satisfied with the result. From being unable to walk a hundred yards, she gradually increased to two or three miles without undue fatigue. By this time she was digesting her food, sleeping well, and had put on weight.

**Class of Case Benefited.**—In all cases of dyspepsia, due to worry, anxiety, or nervous exhaustion, great benefit can be obtained; also in diarrhoea, or irritating catarrhal conditions of the bowels. General and local treatment should both be given, but it is not necessary to go further than the first or second degree to obtain good results. Marasmic children, or those suffering from chronic catarrh of the bowels, do well on this treatment. It is wonderful to see what a general toning-up bath twice weekly for two or three months will do for these youngsters. Appropriate feeding is necessary, and helps the treatment.

**Cirrhosis of the Liver** and chronic lesions of the gall bladder may also be expected to do well with general and local treatment.

## CHAPTER XVIII

### GENITO-URINARY SYSTEM

Class of case benefited—Prostatitis—Amenorrhœa—Dysmenorrhœa—  
—Vaginitis and Cervicitis—Erosion of the Cervix uteri—  
Leucorrhœa—Cystitis—Orchitis and Epididymitis.

GOOD results have been noted in a number of these cases; how it occurs in some of them, it is difficult to state. Is it not a fact in medicine that a good many of our results are hard to explain? We get them, and I am afraid that most of us are satisfied to let it remain at that, although a few try to discover how these results are brought about.

**Class of Case Benefited.**—Most of these genito-urinary cases, and especially kidney cases, are in an anæmic condition, which condition is certainly capable of relief. A general improvement in metabolism, with possibly elimination of some of the waste product, can be brought about. By getting rid of these poisons, the headaches, langour that anyway accompanies most of the kidney cases, and advanced prostate and urethritis cases, are benefited. That the actual disease itself is improved or stayed is doubtful; still, it is something to get some improvement or amelioration of their symptoms. In these cases it is not necessary to give a third degree erythema; a first, or possibly a second, is quite sufficient, but the whole body should be carefully gone over, and in kidney troubles a local treatment may be called for.

**Prostatitis.**—Several workers have claimed improvement in this class of case by giving relief to the frequency of



micturition and from pain. The difficulty is in getting at the prostate, and unless a quartz applicator with a slight curve is used, one cannot be sure that the rays will reach it. Those who use these quartz applicators must remember that there is only a very slight angle to which the pencil may be bent to allow the ultra-violet ray to travel along its length. If the quartz is bent to a right angle, the ultra-violet ray will not follow the angle. Therefore, when ordering these applicators, the operator should be careful from whom they are purchased, and that the correct angle has been obtained. Those cases of prostatitis upon which the writer has personally tried ultra-violet radiation have been disappointing. Ultra-violet with diathermy has been claimed as successful; in combination with the latter possibly good results may be obtained.

**Amenorrhœa.**—Good results can be obtained in these cases by stimulating the menstrual flow. In young girls this symptom is a common complaint, and one that frequently comes before the general practitioner. The mothers of these girls cause the practitioner a great deal of worry because this natural flow has temporarily ceased. Considerable pressure is sometimes put upon the family doctor to give powerful drugs in order to bring it on, but if a girl is healthy, and there is no real cause such as pregnancy, it will as a rule come on of itself in due course. A very frequent cause being anæmia, worry, or some such condition, ultra-violet radiation undoubtedly does these cases good, and effects the desired result without any drug being necessary. At the same time, the girl will gain in health by the treatment, and it is also likely to be more lasting than any drugging for this purpose.

**Dysmenorrhœa.**—This complaint, a very common one in young girls, even more so than amenorrhœa, and unlike the latter, a very painful one, can be greatly benefited, if not cured, by ultra-violet radiation; some add diathermy.

**Schittenhelm Couch.**—If the latter is given, the electrode placed upon the abdomen should have towels soaked in saline solution placed under the metal plate so as to ensure a deep effect. The positive pole is attached to this electrode, the negative electrode being attached to a Schittenhelm couch (as described in Dr. Cumberbach's book), the current depending upon the size of the electrode.

That the irradiation is sufficient in itself to relieve this effect, will be found the invariable rule. The general bath should be given, and a local erythema of the third degree over the ovaries and uterus. The treatment should be given some days before menstruation commences, and carried out when the period is on, either every day or every second day. Excellent results attend this treatment as a rule.

**Number of Treatments.**—To effect a cure, a course of fifteen to twenty treatments is usually required, care being taken afterwards that for at least two or three menstruating periods the local treatment over the ovaries and uterus is given, then one or two periods missed, and two or three treatments given again just before menstruation comes on. Hysterical symptoms which occasionally accompany these menstruations are checked.

**Vaginitis and Cervicitis.**—Here again great benefit is obtained, and these parts are fairly easy of access; the small tungsten lamp will be found most beneficial.

**Position of Patient.**—The patient should be put in the lithotomy position; if a young girl, care should be taken that she is exposed as little as possible, and the presence of the nurse never dispensed with. It will be found that the duck-bill speculum answers very well in these cases to bring the parts into view. However, if the cervix is somewhat retroflected, it may be necessary to use a vulsellum to bring it into view; this does not, as a rule, give much pain, the cervix not being over-sensitive. Two to three minutes' radiation will be required, at about a distance of half a foot.



**All Folds Removed.**—In treating vaginitis, great care must be taken that the folds of the vagina are eradicated; this can be very easily done by getting the nurse to cause a slight pull on the vagina with the speculum, or by substituting a dilatable speculum for the duck-bill variety, thus causing a slight stretch upon the walls of the vagina. If this is not done, it will be found that the bottom of the folds escape treatment, and the desired result is not obtained.

**Erosion of the Cervix Uteri.**—This condition may be treated as described in vaginitis and cervicitis, but if it is found difficult with the tungsten arc lamp, the mercury vapour lamp with a special quartz applicator can be substituted. Good results are obtained.

**Leucorrhœa**, associated with vaginitis, is very successfully treated with ultra-violet radiation. Care should be taken that all discharge is removed with cotton-wool mops before the treatment is applied. Another very successful method for this disease is diathermy, with special egg-shaped metal electrodes. This treatment is so well known that it is not necessary to describe it further.

**Cystitis.**—Ultra-violet radiation has been fairly successfully applied to this disease, but possibly the old methods of treatment will be found the best. Unless proper applicators are used, not much success is likely, and only then in skilled hands.

**Orchitis, and Epididymitis.**—The pain of these conditions can be relieved by irradiation. The general baths and local application as well should be given. The small tungsten lamp will be found specially useful in these cases.

## CHAPTER XIX

### CIRCULATORY SYSTEM—HIGH BLOOD PRESSURE

Amount of fall—Cases which respond best—Anabolin.

THOSE suffering from the effects of high blood pressure, whatever the cause, find great benefit from exposure to ultra-violet ray. Possibly this is due to the dilation of the superficial vessels, but it is certainly not due to this alone, otherwise the effects would be transitory, which is not the case. Exactly how it acts is somewhat difficult to explain, but that they do get great benefit is certain, though it is not necessary to give more than a toning-up bath.

**Amount of Fall.**—Good results can be obtained with both the tungsten arc and mercury vapour lamp. The blood pressure should be taken and noted before and immediately after giving the bath; it has been noticed that in many cases a fall of between 20 mm. and 30 mm. has been effected in one sitting. It must not be expected that this fall will remain so for long after the first treatments. It is generally observed that it is maintained for a considerable time after all the treatments have finished. If the pressure is taken before each bath (as it should be), it will be noticed that it is lower at each taking than it was before the preceding bath, with a gradual fall of 30 to 40 mm. or even more, which remains steady at the end of fifteen to eighteen treatments. In one case the writer had a drop from 200 to 165 mm. after twelve treatments, and it remained steady for many months.



It is as well to continue the treatment for some weeks after the lowest point is reached.

If quick results are wanted, combine ultra-violet radiation with the thyroid and potassium permanganate treatment, to which reference has been made in the chapter on eczema.

**Cases which will respond best** are those due to functional causes, such as severe emotional disturbances, worry, or mental depression. The latter probably respond best to the combined treatment referred to above. Good results are also met with in kidney troubles, and in arterio sclerosis. If, after a course of treatment, a patient finds a recurrence of the old symptoms, such as vertigo and singing in the ears, a further course of treatment should be advised.

**Anabolin.**—There is a new treatment now available for high blood pressure, called anabolin, which practically guarantees to remove all blood pressure, whatever the cause. Not having had any experience of it, one hesitates to recommend it.

As a rule, results with the ultra-violet rays are quickly obtained, and from six to twelve treatments should suffice.

In diseases of the heart, of valvular origin, where the heart is possibly generally hypertrophied, good results are sometimes effected when the general bath, with local treatment over the heart, is recommended.

## CHAPTER XX

### DISEASES OF THE BLOOD AND DUCTLESS GLANDS

Endocrine glands—Anaemia—Chlorosis.

**Endocrine Glands.**—Good results have been effected in treating these glands with ultra-violet radiation. Although only a few cases have come under the writer's personal notice, its effect on the suprarenal is said to be of a stimulating nature, but before giving a definite opinion upon the effect of this ray in these cases, it would be necessary to see a larger number. Ultra-violet radiation also stimulates the sexual glands.

The following case of enlarged thyroid came under my treatment :

The patient was a woman of about 45 years of age, and had suffered for some years with enlarged thyroid. The left gland had been removed by operation ; the right was about the size of a hen's egg. She was extremely anæmic and listless, and became exhausted with very little exertion. Thyroid gland extract had been tried with but little effect. She was put on a general bath, and local ray was applied over the gland. Iodex was also massaged into the gland after each treatment. It reduced considerably, and the patient felt great benefit after two months' treatment of three baths a week. The exhausting feeling had gone, and she was able to move about and resume her ordinary occupation without tiring.



into the canal. The writer has had special reflectors made for this purpose.

**Otitis Media, Acute and Chronic**, give good results with the ultra-violet ray. In the chronic form a number of patients suffering from deafness due to this disease, have declared that they have found great benefit from the ray.

The writer's procedure, after ascertaining that the ear is quite clear, and that nothing obstructs the view to the drum, is to apply the ray with the hand lamp, directed to the drum for half a minute. The mastoid cells behind the ear should also be rayed, and a first or second degree erythema is sufficient. Two weekly treatments is the average, and the length of each treatment should be very gradually increased. Rapid progress must not be expected in these cases; care, and not a rapid cure, being the prime factor. Several cases of eczema over the mastoid cells have been treated and cured. A third degree erythema is required, and treatment twice weekly is sufficient; as a rule, six treatments clear up the trouble. The best results are obtained in eczema cases, but owing to the small space through which to operate, it is exceedingly difficult and tedious to direct the ray upon the part required.

## CHAPTER XXII

### DISEASES OF THE EYE

Conjunctivitis: chronic and tubercular—Corneal ulcers, opacities, and cataract—Irido-cyclitis, Phlyctenular choroiditis, and sympathetic Ophthalmitis.

**Conjunctivitis : Chronic and Tubercular.**—These diseases are amenable to the ultra-violet ray, but special care must be used in treating any part of the eye; only those with special knowledge and apparatus should attempt it, as great damage can otherwise be done. Corneal opacities can be treated with the air-cooled lamp. Sampson states that he has had good results in certain trachoma cases, giving the third degree erythema with the quartz rods. Conjunctivitis is easily caused with the ultra-violet ray when using the lamps, or by reflection from the walls of the treatment room.

**Corneal Ulcers, Injuries to Cornea, Corneal Opacities, Cataract.**—All these have been treated with ultra-violet radiation, but, as remarked before, it is not advisable to attempt these cases, unless experienced in this class of work. In treatment of eye diseases, the general bath must not be despised any more than in the other many diseases described in this book, and local treatment should also be used. It must further be noted that the ultra-violet ray treatment must not be started in the "acute stage." It is an accepted fact that the best time is immediately after the acute symptoms have settled down, and before the chronic stage



has commenced, so that the case is taken before the accumulation of organised deposits, or extensive tissue degeneration and destruction.

Dr. W. Stewart Duke-Elder, who has given a great deal of time to this treatment, and amassed a quantity of valuable evidence from the number of cases under his care, speaks very highly of the results with the ultra-violet ray. He rightly warns operators that "they must not push the treatment; that whereas in some patients the treatment is astonishingly rapid, in others it is extremely slow, and calls for great patience in all concerned. The dosage should never be increased beyond the safety limit."

The bath tones up the patient, sleep and appetite improve, and a general fitness pervades the whole system.

Dr. Duke-Elder further states that "it is only those waves which are absorbed, which can have any action. It may be taken that all waves shorter than 2,950 Å.U. are completely absorbed by the cornea, and that above this level an ever-increasing percentage is transmitted, until at the region of 3,100 Å.U. to 3,150 Å.U. practically all are transmitted to the underlying lens and iris. The lens absorbs all radiation incident upon it below 3,200 Å.U., practically all that below 3,500 Å.U., and continues to absorb an ever-diminishing amount up to a limit, which varies with the age and the degree of sclerosis, but which may be taken to average 4,000 Å.U.; the retina is reached, therefore, by all the incident radiation in this spectral region above 4,000 Å.U., and by some of the incident radiation down to wave-lengths as short as 3,200 Å.U. The pigment in the iris absorbs all wave-lengths that fall upon it, and degrades the energy into heat."

It will be seen by this, that unless the operator has the correct screens for the necessary wave-lengths, it is quite impossible to treat this subject, without doing a great deal of harm to the eye, or to get the benefit they wish from it.

**Irido-cyclitis, Phlyctenular Ophthalmia, Choroiditis, and Sympathetic Ophthalmitis.**—Good results have been obtained in all these. There are many more diseases of the eye that have been, and as time goes on will be, treated with the ultra-violet radiation; however, those mentioned will show the great progress already made in this subject.

As previously emphasised, unless this is given the most careful attention, great damage may be done.



## CHAPTER XXIII

### SUMMARY OF DISEASES

THE summary of diseases given below, with their appropriate treatment, has been compiled as a refresher for the busy practitioner, and with a view to saving him time and unnecessary trouble in wading through several pages for any desired information.

It must be understood that idiosyncrasies or peculiarities of patients have not been taken into consideration. Only the ordinary dosage has been indicated, therefore practitioners should first read the book carefully.

#### A

**Acne vulgaris.**—Strong dose to be given at once with the mercury vapour lamp to third or fourth degree. Keep patient on simple diet, avoiding all food of a greasy nature. Plenty of exercise to be taken, and the bowels kept regular. Doses should be so strong that the skin peels off; when new skin is formed, reduce the strength of the dose.

**Actinomycosis (a form of lupus).**—Mercury vapour lamp, third or fourth degree erythema. General bath.

**Alopecia (baldness).**—Mercury vapour lamp. Give a general bath followed with local treatment to affected areas; third or fourth degree always necessary. The lamp should be about a foot away. It must be remembered that the head stands a good deal of ray, and three or four minutes is therefore necessary. In the seborrhœic variety give local treatment as above every second or third day.

**Amenorrhœa.**—General bath with either the mercury vapour or tungsten lamp. Local treatment over the pubic area.

**Anæmia.**—General bath with the tungsten or carbon lamp, or with both, working up to fifteen or twenty minutes. If carbon only is used, treatment can be worked up to an hour.

### SUMMARY OF DISEASES

**Asthma.**—General bath with either the tungsten or mercury vapour lamp; local treatment over the chest to the second degree. Inhalation of tungsten fumes. (*See Colds.*)

#### B

**Blood-pressure.**—General bath is all that is necessary, with either the tungsten or mercury vapour lamp.

**Boils (Furunculosis).**—Mercury vapour lamp applied locally with compression for two or three minutes, until a third or fourth degree erythema is produced.

**Bronchitis.**—General bath with the tungsten or mercury vapour lamp, and local treatment over the chest to the second degree. If mucous is considerable, give inhalation. (*See Colds.*)

**Burns (simple).**—Light to be continuously kept on day and night. Apply ultra-violet ray every second day for three or four minutes. First degree only required. No dressings.

#### C

**Carbuncles.**—The tungsten lamp generally and locally over affected part. If applied early enough it may prevent the formation of pus.

**Cataract.**—(For treatment, *see* Corneal ulcers.)

**Cervicitis.**—(For treatment, *see* Vaginitis.)

**Cervix, erosion.**—(For treatment, *see* Vaginitis.)

**Chlorosis.**—(For treatment, *see* Anæmia.)

**Choroiditis.**—This requires appropriate filters before applying the ray.

**Cirrhosis of the liver.**—General bath with the tungsten lamp, and local treatment over the liver area.

**Colds (common).**—General bath with the tungsten or mercury vapour lamp, with inhalation of the tungsten fumes. The cold will be prevented if the treatment is started early.

**Conjunctivitis (tubercular, etc.).**—Apply the ray locally with appropriate filters. Treatment should only be given by an expert.

**Corneal opacities.**—(*See* Ulcers (corneal).)

**Corneal ulcers.**—(*See* Ulcers (corneal).)

**Cough (chronic).**—General bath, with local treatment to throat.

#### D

**Duodenal ulcers.**—(*See* Dyspepsia.)

**Dysmenorrhœa.**—(*See* Amenorrhœa.)

**Dyspepsia (gastric ulcers, duodenal ulcers).**—General bath with the tungsten lamp, and local treatment to the pit of stomach. Second or third degree erythema.



## E

**Ear-eczema.**—General bath with the mercury vapour lamp. Local treatment to the ear internally or externally with small local raying lamp, or with the mercury vapour and quartz pencil. *See* that all wax is removed.

**Eczema.**—By far the best results are obtained with the mercury vapour lamp. Give a general bath followed by local treatment; dosage depends on the severity of the inflammation, which, if pronounced, will necessitate a first or second degree erythema, with subsequently a third degree, to the affected areas, taking care to cover the surrounding skin. The thyroid and permanganate treatment in combination sometimes hastens cure. There is no object in giving mild doses.

**Endocrine glands.**—Give the general bath, with local application of tungsten to the first or second degree.

**Epididymitis.**—(For treatment, *see* Orchitis.)

**Erysipelas.**—Give the mercury vapour lamp for a second or third degree erythema, followed by the ordinary methods. Doses should be followed up every twenty-four hours.

## F

**Fibrositis.**—(*See* Rheumatism.)

**Frost-bite.**—General baths with the tungsten or mercury vapour lamps for some minutes. A second degree only is admissible.

## G

**Gastric ulcer.**—(*See* Dyspepsia.)

## H

**Hæmorrhoids.**—Apply the tungsten ray to external, and quartz pencils to internal piles.

**Hay fever.**—Give the general bath, and apply the ray direct to the nasal mucous membrane with the small raying lamp or with quartz pencils.

**Herpes (shingles).**—General bath with the mercury vapour lamp, followed with a third degree erythema over the most painful spots. Tungsten may also be used—good results with either.

## I

**Ichthyosis (fish skin or scaly skin).**—Use the mercury vapour lamp, giving a third degree dose. Many treatments are required.

**Impetigo.**—*See* that all crusts are removed. Use the mercury vapour lamp, giving a general bath, with local application to the second or third degree.

**Irido-cyclitis** requires appropriate filters before the ray can be applied.

## K

**Keloid (scar).**—Give the general bath, with a third degree erythema over the scar. The mercury vapour or tungsten lamp may be used. Repeat the dose when the erythema has faded.

## L

**Leucoderma (white skin).**—Give a second or third degree erythema with the mercury vapour lamp or the tungsten. If benefit is derived, it will only be after twenty or thirty treatments.

**Leucorrhœa.**—Remove all discharge, and give the treatment as in vaginitis.

**Lichen Planus.**—Use the mercury vapour lamp. General baths of mild application are enough. Give local application where necessary.

**Lumbago.**—(*See* Rheumatism.)

**Lupus.**—Use the carbon lamp, and commence with fifteen minutes, gradually increasing to an hour a day. The tungsten lamp may also be used. Give general treatment, with local application where required.

## M

**Moles (Nævi).**—If any good is to result in these cases, a fourth degree erythema must be obtained; when healed, repeat the dose if necessary. The water-cooled mercury vapour lamp is required, with compressor.

## N

**Nævi, capillary.**—Treatment as in moles; if large, they should be treated piece by piece.

**Neuralgia.**—Apply tungsten, or long-wave lamps such as tungsten, steel, etc., generally, and locally along the course of the painful nerve. Erythema to the second or third degree.

**Neurasthenia.**—General treatment with the mercury vapour or tungsten lamp. It is not necessary to go beyond a first degree. Give radiant heat first for fifteen minutes; it is often very soothing to the patient.

**Neuritis.**—(*See* Sciatica.)

## O

**Operations (after).**—(For treatment, *see* Toning up.)

**Ophthalmitis (sympathetic).**—(*See* Choroiditis.)



- Orchitis.**—Give the general bath and local ray with tungsten. Care should be taken not to obtain more than a first or second degree erythema.
- Otitis media.**—Apply the ray to the ear, and also to the mastoid area. (*See Ear-eczema.*)
- Ozæna.**—Give the general bath and ray direct to the nasal mucous membrane and back of throat with the tungsten or mercury vapour lamp. All crust and mucous must first be removed.

## P

- Paralysis agitans.**—Apply general treatment with tungsten or metal-  
lium lamps, and locally to any painful spots.
- Peritonitis, tubercular.**—Tungsten or carbon for general treatment,  
with tungsten over the abdominal area to the first or second  
degree.
- Pernio, Erythema (chilblain).**—Give a general bath, and second degree  
with the mercury vapour lamp combined with continuous or  
sinusoidal current.
- Pharyngitis.**—Apply the tungsten ray direct to the pharynx, for a  
second degree.
- Phlyctenular ophthalmia.**—(*See Irido-cyclitis.*)
- Phthisis.**—(*See Tuberculosis of the lungs.*)
- Pityriasis.**—General bath, with local application for a second degree.
- Poliomyelitis, anterior.**—General bath with tungsten, etc., or mercury  
vapour lamps give good results. Start treatment as soon after  
the attack as possible. Electric treatment in some form is also  
required; first degree only. Many treatments will be necessary.
- Prostatitis.**—Give the general bath, and mercury vapour ray with  
quartz pencil to the prostate. Care should be taken that the  
angle is not too acute, otherwise the ray will not follow.
- Pruritus (irritation).**—Mercury vapour or tungsten lamps can be used,  
but the former is best. Erythema to the second or third degree.  
General bath is advisable.
- Psoriasis.**—Give a third degree erythema over the affected spot, and  
general bath with permanganate of potassium treatment.
- Purulent wounds.**—Use the mercury vapour lamp after removing all  
débris; give a second degree erythema, and general bath.
- Pyorrhœa alveolaris.**—Use the mercury vapour or tungsten ray on  
the gums. The general bath should always be given, and the  
gums rayed for three or four minutes.

## R

- Rejuvenation.**—General bath with the mercury vapour or tungsten  
lamp. First degree.

- Rheumatism (acute and chronic).**—Give tungsten generally and  
locally, or metallium, etc. For good results obtain erythema to  
the second or third degree locally. Treatment to be given every  
forty-eight hours, in combination with the old methods if neces-  
sary.
- Rhinitis (atrophic, etc.).**—(*For treatment, see Ozæna.*)
- Rhinophyma (hypertrophic thickening).**—A second or third degree is  
necessary direct to the affected part.
- Rickets.**—Carbon or tungsten general baths, first degree only. Start  
generally and gradually increase.
- Rosacea.**—Tungsten, metallium, or mercury vapour lamp. Give the  
second degree in mild, and third degree in severe cases.

## S

- Sciatica.**—Give general and local treatment with the long waves,  
using tungsten, metallium, etc.; local treatment to the third  
degree for quick results. Appropriate diet to be observed.
- Seborrhœa.**—Give the general bath, followed by a second or third  
degree locally. The mercury vapour lamp should always be  
used. Twelve to fifteen treatments may be necessary to clear  
the skin.
- Septic wounds.**—Clean the wound thoroughly, and apply the mercury  
vapour lamp. A second or third degree is necessary, and as the  
new skin forms, it should be protected from the ray.
- Stomatitis.**—For treatment, *see* Tonsillitis, but vaccines must be given  
as well.

## T

- Telangiectasis.**—A fourth degree required; quartz compressors are  
best.
- Tic douloureux.**—(*See Sciatica, but owing to its situation, more care  
must be taken in application.*)
- Tinea tonsurans.**—Use mercury vapour lamp for a third degree,  
giving three or four minutes at a foot distant. The hair must be  
cut very short. Ionisation with copper can be combined some-  
times, or bathing with saturated solution of Epsom salts, before  
ultra-violet ray applied.
- Tinea versicolor.**—A third or fourth degree necessary with the  
mercury vapour lamp.
- Toning up.**—Apply general treatment with the tungsten, mercury  
vapour, or carbon lamp. Commence with treatments of fifteen to  
twenty minutes' duration, gradually working them up to an hour.
- Tonsillitis.**—Give the general bath with the ray direct to the tonsils,  
either with tungsten or mercury vapour with quartz pencils, for  
three or four minutes.



## U

**Ulcers (corneal).**—These can be treated by ultra-violet with appropriate filters.

**Ulcers (granulating).**—Give the general bath with the mercury vapour lamp. Erythema to the second degree, the surrounding skin being protected.

**Urticaria.**—General bath with the tungsten or mercury vapour lamp. Vaccines and dieting are necessary.

## V

**Vaginitis.**—Special care must be taken to remove the folds of the vagina. Apply tungsten ray locally with the small lamp. The general bath should also be given. The mucous membrane will stand a good deal of the ray, which may be applied for three or four minutes.

**Varicose ulcers.**—Give the general bath, and mercury vapour lamp locally to the ulcer, care being taken to protect the new skin as it forms.

**Vincent's Angina.**—General bath, and local application to the throat.

## W

**Whooping cough.**—General bath, and locally over the lungs with the tungsten lamp; also inhalation of tungsten fumes as mentioned in the section on common colds. A second degree is quite sufficient.

## X

**Xeroderma (dry skin).**—A second degree is all that is necessary, given with the mercury vapour lamp.

## INDEX

## A

Abscesses, 82  
Accumulative result of ray, 16  
Acne vulgaris, 97  
Actinomyces, 83  
Actinoscope, 36, 40, 44  
Advantage in artificial sunlight, 15  
Air-cooled lamps, 14  
Alopecia, 95  
Alps, 6, 11, 16  
Alps model portable mercury vapour lamp, 30  
Altitude and ultra-violet ray in winter and summer, 11  
Alton, 6, 16, 106  
Amber glass, 55  
Amenorrhœa, 128  
Amperage, 43  
Anabolin, 132  
Anæmia, 78, 128, 134  
    pernicious, 134  
Angstrom unit, 36  
Apex lamp, 31  
Areata variety of alopecia, 96  
Arc carbon, 12, 16, 17, 18, 32  
    closed in vacuum, 14  
    closed at atmospheric pressure, 14  
    lamp, author's tungsten, 21  
        closed, 13, 19  
        multiple carbon, 31  
        open, 13, 16, 19, 73  
        Sunic tungsten, 31  
        tungsten, 19, 73  
        tungsten and carbon, 23  
lamps, 13  
    closed in argon, air-cooled, 14  
    striking the, 24, 29  
    striking in Alps model mercury vapour lamp, 30  
Arkos glass, 52, 55  
Arnold Paige, Dr., and *British Medical Journal*, 66  
Arthritis, 15  
Artificial sunlight, 13  
Asthma, 119

## B

Bacteria, effect of ultra-violet ray on, 6, 38  
    wave-lengths for destruction of, 79  
Baldness (*see* Alopecia), 95  
Bernhard of Samaden, and putrefaction of meat, 8  
Bertrand, 6  
Blistering, 12  
Blood of patients, 3  
    pressure effects of ultra-violet ray, 130  
    testing, 16  
Blue rays, 7, 13  
Blunt, 6  
Body bath, 82  
Boils, 82  
Bolometer, 37  
Bones, tubercular, 6  
Bonnet, Dr., 8  
Bowels, catarrhal irritation of, 126  
Brazil and crystal quartz, 50  
British Hanovia Co., 24  
*British Medical Journal*, 93, 109  
Bronchial asthma, 119  
Bronchitis, 120  
Bronzing of skin in ultra-violet ray, 9  
Browning, 38  
Burns by X-ray, 12  
Burns, simple, 103

## C

Cabinet, electric light, in burns, 104  
Cæsium, 7  
Calcium, 134  
Cancer, 16  
Capillaries, dilation, 14  
Carbon and tungsten lamp combined, 73  
    bath, 17  
    dioxide, 33, 102  
    impregnated, 27, 43, 45  
    monoxide, 33  
    plain, 31, 32, 43, 44, 45, 48  
    tetrachloride, 39



Carbuncle, 82  
 Cataract, 137  
 Cervicitis, 129  
 Cervix uteri, erosion of, 130  
 Charcot, 8  
 Chemical tests for lamps, 39  
 Chilblains (*see* Erythema pernio), 86  
 Chlorosis, 134  
 Chorea, 116  
 Choroiditis, 139  
 Circuit wires, 62  
 Cirrhosis of liver, 126  
 Clinicians working together, 16  
 Cobalt or welder's blue, 53  
 Coci, effect of ultra-violet ray on, 82  
 Cold, common, 116  
 Colour as a cure, 62  
   index, 113  
   its wave-length and frequency, 36  
   treatment in eczema, 94  
 Congestion, deep-seated, 14, 15  
 Conjunctivitis, 51, 137  
   treatment of, after ultra-violet ray  
   exposure, 70  
 Copper ionisation in Tinea, 87  
 Corneal ulcers, 51, 52  
   injuries, 137  
   opacities, 137  
 Couch, portable, 61  
 Cough, chronic, 120  
 Cowell, Dr. S. J., and experiments on  
   children with ultra-violet ray,  
   110  
 Cox, Mr. Stanley, 22, 49, 61  
 Crookes, Sir Wm., O.M., 52  
 Crookesite and Crookes A and B, 54  
 Crown glass, 50, 55  
 Cruxite, 54  
 Crypts in tonsils, 122  
 Culimator, 35  
 Cumberbach, Dr., 129  
 "Cure-all," 15  
 Cyanogen in heliol lamp, 33  
 Cystitis, 130

## D

Dark Ages, 6  
 Detection and measurement of ultra-  
   violet wave-length, 39  
 Diabetes, 16  
 Diarrhoea, 126  
 Diathermy cauterisation, 102  
 Diathermy, and treating ulcerations  
   to soften scar tissue, 86  
 Dieting, 3  
 "Don'ts," 75

Dosage, 57  
   accuracy, 15  
 Dose, over, 65  
 Dosimeters, 65  
 Downes, 6  
 Dry skin. (*See* Xeroderma.)  
 Duke-Elder, Dr. W. Stewart, 138  
 Duodenal ulcers, 125  
 Duralumin reflector, 30  
 Dust, 11  
 Dysmenorrhoea, 128  
 Dyspepsia, 125, 126

## E

Eczema, 65, 81, 91  
   in combination, 90  
   of external ear and auditory canal,  
   135  
   over mastoid cells, 136  
 Egyptians, 6  
 Endocrine glands, effect of ultra-  
   violet ray on, 133  
 England, and effect of atmospheric  
   impurities on ultra-violet ray, 133  
 Epididymitis, 130  
 Epsom salts, 87, 95, 100  
 Erysipelas, 90  
 Erythema, 12, 58  
   classification, 67  
 Expometer, 33, 34  
 Eyes, tested, 16

## F

Face-mask, 56  
   where obtained, 69  
 Falling asleep unattended, 2  
 Faure, 6  
 Fibrositis, 113  
 Fieuzal, 53, 55  
 Filament lamp, 14  
 Finsen, Prof., on tubercular disorders,  
   7, 106  
 Finsen's lamp, 7  
 Fissure, cause of pruritis, 88  
 Fleming's, Messrs. R., special glasses,  
   for ultra-violet ray, 70  
 Fog, 11  
 Food experiments with ultra-violet  
   ray, 111  
 Frost-bite, 84  
 Furunculosis, 82  
 Fuses, 62

## G

Gauvain, Sir Henry, 6, 16, 106, 108  
 Glands, tubercular, 6

Goggles, 51, 52, 56  
   and testing, 53  
   under photographic tests, 54  
 Golfing, exercise, 4  
 Gout, 14  
 Grange, Mr. R., 1  
 Greeks, 6  
 Green ray, 13

## H

Hæmoglobin, 3, 78, 134  
 Hæmorrhage in phthisis, 109  
 Hæmorrhoids, 125  
   cause of pruritis, 88  
 Hay fever, 120  
 Hayling Island, 6, 106  
 Helio lamp, 32  
 Heliotherapy on tubercular bones, 8  
   curing disease in early times, 5  
 Herpes, 96  
 Herpes Zoster, Genitalis, and  
   Facialis, 96  
 Hertzian waves and their length, 36, 37  
 Hewitt, Peter Cooper, use of thallium  
   and caesium in quartz mercury  
   vapour arcs, 7  
 Hilger, Adam, quartz spectroscope,  
   42, 44  
   tests in their laboratories, 54  
 Hill, Dr. Leonard, 10, 12  
 Historical, 5  
 Holweck, Dr., 37  
 Hyperpiesis, 3, 131

## I

Ichthyosis, 100  
 Idiosyncrasy, 65, 66  
 Impetigo, 101  
 Incandescent lamps, 13, 14  
 Indigo rays, 13  
 Influenza, 3, 78  
 Infra-red, 12, 16, 37, 51, 53, 58, 75  
 Infra-red causing corneal ulcers, 51,  
   52  
 Insurance, 62  
 Intensity in different electrodes, 43  
 Iodine, 39  
 Iridis cyclitis, 139

## J

Jesionck lamp, 29

## K

Keloid, 101  
 Kromayer, Prof., method of cutting  
   off excessive heat in non-pene-  
   trating short wave-lengths, 72

Kromayer water-cooled lamps, 24,  
 72, 87, 107

## L

Laity, 2  
 Lamps, 19  
   care of, 70  
   deep therapy, 104  
   suitable for general practice, 1  
   suspended over patient, 18  
 Langley, Prof., and bolometer, 37  
 Lebert, 8  
 Lenses, pebble, 50  
 Leucocytes, 113, 134  
 Leucoderma, 88  
 Leucorrhoea, 130  
 Leysin, 6, 15, 106  
 Lichen Planus, 100  
 Light, diffused, and ultra-violet ray,  
   11  
 Lithotomy position in treating  
   vaginal pruritis, 89  
 Local raying lamp, 27  
 Loebel, 6  
 London Hospital, and Prof. Finsen's  
   raying lamp, 7  
 London smoke glass, 53  
 Lorand, 79  
 Luckiesh, 36  
 Lumbago, 15, 112, 114  
 Lupus, 69, 105, 106  
   catarrhal, 106  
   fibroid, 106  
   vulgaris, 106  
   wart, 106  
 Lyman, and absorbent atmosphere  
   in ultra-violet ray, 37, 38  
 Lymphocytosis, 79

## M

Marasma, 126  
 Mercury vapour lamps, 13, 29, 51, 66,  
   69, 71  
 Mercury vapour lamp lighting, 26  
 Metallic electrode analysis, 48, 49  
 Metallium, 17, 21, 22, 48  
 Methylene blue, 39  
 Millikan, Prof., 37  
 Moles, 101  
 Montana lamp, 29  
 Multiple carbon arc lamps, 31

## N

Nævi, 101  
 Nævi capillaries, 102



Natural sunlight, 11  
 Neuralgia, 116  
 Neurasthenia, 116  
 Neuritis, 14, 28, 79, 115  
 Newton, Sir Isaac, 6  
 Nickel reflectors, 75  
 Nott, Dr., permanganate and thyroid treatment, 3, 93  
 Noviweld glass, 53, 55

## O

Open air in tuberculosis, 105  
 Ophthalmia, phlyctenular, 139  
 Ophthalmitis, sympathetic, 139  
 Orange rays, 13  
 Orchitis, 130  
 Osteo-arthritis, 8  
 Otitis media, 136  
 Ozæna, 123

## P

Pain, 14  
 Palm, Dr. T. A., 110  
 Paralysis agitans, 116  
 Patients, effect on, 16  
 Patients' colouring in relation to ultra-violet ray, 65  
 Peeling of skin, 12  
 Pediculi cause of pruritis, 88  
 Pernio, erythema, 86  
 Pfund glass, 53  
 Pharyngitis, 123  
 Phosphorus, 134  
 Photographic analysis, 45  
   spectroscope, 44  
   tests of electrodes, 44, 45, 49  
 Phthisis, 16, 109  
 Physical laboratory test, 49  
 Pigmentation, 12  
 Pityriasis, 87  
 Poliomyelitis, anterior, 116  
 Port wine stain (*see* Capillary nævi), 102  
 Position for treatment, 65  
 Potassium iodide, 84  
 Potassium permanganate treatment, 3, 90, 93, 132  
 Poulitices, 83  
 Practitioner, general, 3  
 Prostatitis, 127  
 Protection of surrounding skin from ultra-violet ray, 70  
 Pruritis, 88  
   anal or vaginal, 89  
   mental, 88

Psoriasis, 81, 89  
   in combination, 90  
 Purulent discharges, 81  
 Pyorrhœa alveolaris, 123

## Q

Quack medicine, 5  
 Quartz bulb, 14  
   crystal rock, 50  
   fused, 51  
   mercury arc, 7  
   prism, 35  
   rods and applicators, 72  
   rods, correct angle to be bent, 128

## R

Radiant heat, 12, 17, 61, 63  
 Radiant heat apparatus, 28  
 Radium, 7  
 Rats, experiments on, 110  
 Raying lamp, local, 27  
 Rays on patients, clinical results, 78  
 Red corpuscles, 113, 134  
 Red rays, 13  
 Reflectors, composition of, 74  
 Rejuvenation by ultra-violet ray, 79  
 Rheumatism, 14, 15, 28, 75, 79, 112, 115  
   Rhinitis, atrophic, 123  
   Rhinophyma, 90  
   Rheumatic arthritis, 112  
     fever, 112  
     fibrositis, 112  
     muscular, 112  
 Rheumatism, best ray to be employed, 112  
   and combination of treatment, 112  
 Rickets, 3, 78, 110  
   when treatment commenced, 111  
   and X-ray photography, 111  
 Rickli, Dr., 8  
 Robes, 60  
 Rock salt, 36  
 Rollier, 6, 11, 16, 106, 108  
 Romans, ancient, 5  
 Röntgen, and discovery of X-ray, 8  
 Room, 60  
 Room constitution, 60  
 Rosacea, 87  
 Russ, Dr., 38  
 Russell and Russell, Drs., 6, 10

## S

Sampson, Dr., 137  
 Saniweld glass, 52, 55  
 Sarcoma, 80

Sassenachs, 9  
 Schittenhelm couch, 129  
 Schumann, recording ultra-violet areas, 37  
 Sciatica, 28, 75, 79, 115  
 Sclerosis arterio, 132  
 Seborrhœa, 99  
 Seborrhœaic variety of alopecia, 95  
 Shingles. *See* Herpes.  
 Seventeenth-century treatment, 5  
 Sexual glands, effect of ultra-violet ray on, 133  
 Silicon reflectors, 75  
 Silver reflectors, 75  
 Simpson, Prof., 83  
 Sinusoidal current, and chilblains, 86  
 Skin, and bactericidal effect on, 81  
   preparation of, for ultra-violet ray, 69  
 Smoke and ultra-violet ray, 3, 10, 11, 13  
 Somerfield, Mr. H. G., 48  
 Spectrophotograms, 43  
 Spectroscope, 6, 7, 29, 35, 41, 42, 51, 54  
 Spectrum, 6, 7, 11, 12, 29, 36, 62  
   as to quality of ultra-violet ray, 37  
   solar, 36  
   wave-length, 38  
 Steel, 31  
 Stomatitis, 122  
 Sun and actinic ray, 10, 11  
   percentage of ultra-violet ray, 7  
 Sunburn, 12  
 Sunic tungsten arc lamp, 31  
 Sunlight and its variation at different times of year, 11  
   and screening off other rays, 12  
   methods of giving, 12  
   on skin, 12  
 Sun Ray lamp, 26  
 Suppurific, 16  
 Suprarenal gland, effect of ultra-violet ray, 133  
 Sweat glands, dilatation, 14  
 Switchboard testing, 62  
 Sylvine prisms, 37

## T

Technique, 59  
   required, 2  
 Telangiectasis, 103  
 Tennis, 4  
 Testing necessity, 16  
 Thallium, 7  
 Thyroid, enlarged gland, 133  
 Thyroid treatment. *See* Dr. Nott.

Tic douloureux, 116  
 Time for treatment, 63, 67  
 Tinea, tinea tonsurans, 87  
 Tinea versicolor, 87  
 Tonic in wasting diseases, etc., 3  
 Tonsillitis, 121  
 Torticollis, 121  
 Treatment, methods of giving, 71, 77  
 Tubercular conjunctivitis, 137  
   dermatitis and ulceration, 107  
   lungs, 109  
   peritonitis, 108  
 Tuberculosis, 105  
   of bones, 79, 108  
   of glands, 108  
 Tungsten, 31, 60  
   arc lamp (author's), 21  
   and carbon arc lamp, 23  
   radiation, 17  
 Turbinates, hypertrophied, 123  
 Turk, 7

## U

Ulcer, corneal, 137  
   diabetic, 86  
   duodenal, 125  
   gastric, 125  
 Ulcerations treated with ionisation of chloride of sodium to soften scar tissues, 86  
 Ulcers, chronic, 2, 81, 85  
   gangrenous, varicose, 2  
   perforating, 86  
   syphilitic, 86  
   varicose and itching, 86  
 Ultra-violet in different altitudes, 11  
   effect on some patients, 67, 78  
 Uranium, 40, 41  
 Ureteritis, 127  
 Urine testing, 16, 83  
 Urticaria, 88  
 "Uvral" automatically controlled U.V.R. apparatus, 33

## V

Vaccines in combination with ultra-violet ray, 88, 98  
 Vaginal discharge cause of pruritis, 88  
 Vaginitis, 129  
 Veldes in Austria, 8  
 Vincent's Angina, 123  
 Violet rays, 13  
 Visible rays, 13  
 Visual tests of electrodes, 44, 45, 46  
   analysis of, 47  
 Vitaglass, 14



## W

Walking exercise, 4  
Wasting disease, 3  
Water-cooled lamps, 14  
Wave-lengths, 11  
Welder's blue glass, 40, 53  
White blood corpuscles, 3, 134  
Whooping cough, 118  
Worms, cause of pruritis, 88  
Wounds, bactericidal effect on, 2, 5  
    granulating, 85  
    septic, 81

## X

Xeroderma. (*See* Ichthyosis.)  
X-ray, 12  
    burns, 84  
    examination, 16  
    and its nearness to ultra-violet ray,  
        78

## Y

Yeast for boils, 83  
Yellow rays, 13

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